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Orebodies of the Mesabi Range--I

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SYNOPSIS—Supplies additional information to the literature on the Mesabi orebodies. Geologic section. Characteristics of the several formations. Typical structure of orebodies. The layers of ore and waste material in the ore concentrations.

The geology of the Mesabi range has been described most exhaustively in the U. S. Geological Survey monographs Nos. 43 and 52. In 1913 the University of Minnesota published a bulletin entitled "Iron Mining in Minnesota," which contains a great deal of valuable information regarding the range. Numerous articles have appeared in different mining papers and particularly in the *Journal* of late regarding Mesabi range mining practice. Notwithstanding all these publications, some indefinite ideas obtain regarding the structure of Mesabi orebodies, not only among mining men not engaged in work on the range, but even among some directly connected with the work. The two Geological Survey publications referred to are so technical geologically that perhaps few practical mining men have read them thoroughly. The University of Minnesota bulletin mentioned is valuable to the practical man and should be in the hands of everyone interested in the iron-mining industry. But in none of these publications is the structure of the orebodies described or emphasized in such a way as to be of practical value to engineers in the district.

In order to present a practical and untechnical summary of what is known of the physical structure of these orebodies, in such a way as to be of direct value to men in the district, and to present many newly discovered facts hitherto unpublished, this series of articles has been prepared according to the following outline:

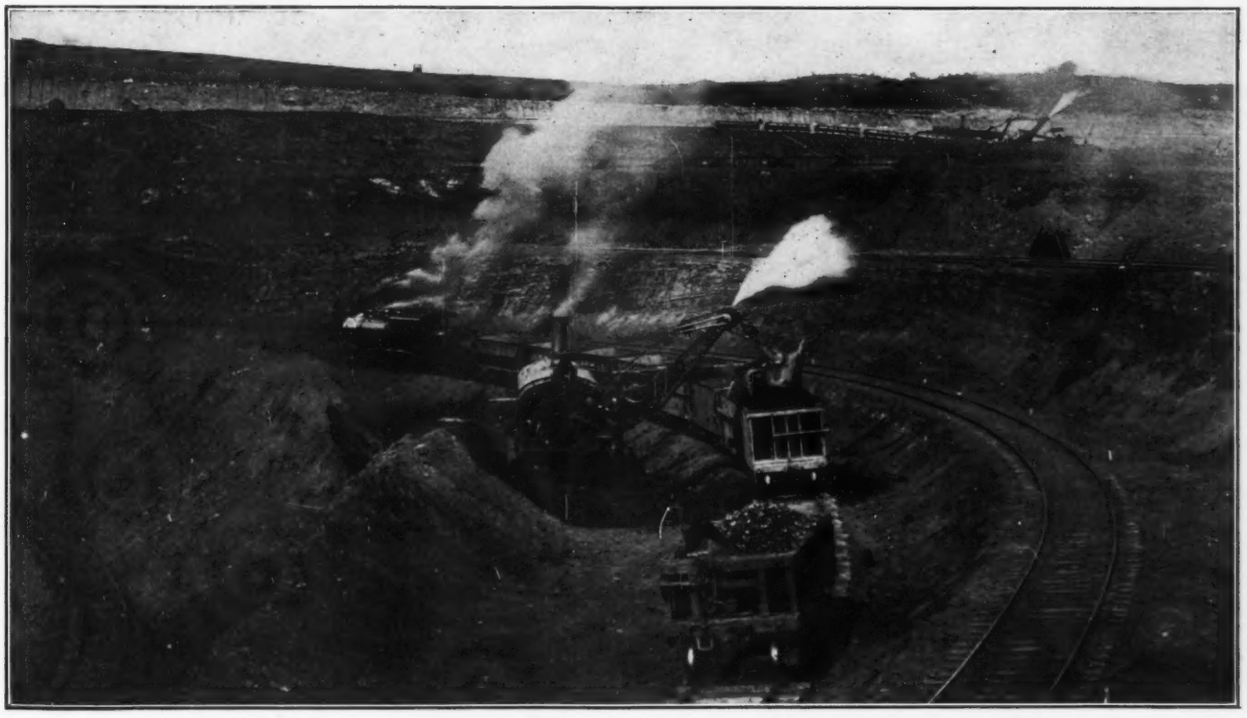

FIG. 1. VIEW IN MAHONING MINE, HIBBING DISTRICT; NOTE DIP OF ORE LAYERS

I. General Geologic Structure
   a. General geology.
   b. Typical structure.
II. Actual Orebodies as Developed.
   a. Sections of developed bodies from different parts of the range.
   b. Special sections showing monoclinal folding and large faults.
III. Exploration and Development.
   a. System of drilling.
   b. Structural development of orebodies from drill records.

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IV. Geologic Formation.
- a. Three types of orebodies: (1) Trough bodies, (2) flat-layer bodies, (3) fissure bodies.
- b. Geologic conditions causing these three types of orebodies.

These articles present information drawn from a great many sources, from exploration and operating records of the different mining companies and from personal investigations and studies of many engineers in the district.

It is not the purpose here to enter into any details of mining practice or engineering work, beyond the exploration of orebodies and the interpretation of such exploration records, although Fig. 1 shows a typical steam-shovel operation in the Mahoning pit. The practical value of these articles to the engineers in the district will consist of the explanation of how to work out most accurately the structure of the bodies from the results of the drill explorations. A fairly uniform practice in this matter is followed by several mining companies, but it is believed that the present articles will add considerably to general knowledge on this subject. In Fig. 2 is presented a map of northern Minnesota showing the extent and horizontal configuration of the Mesabi range with its relation to the other Minnesota ranges, the Vermilion and the Cuyuna.

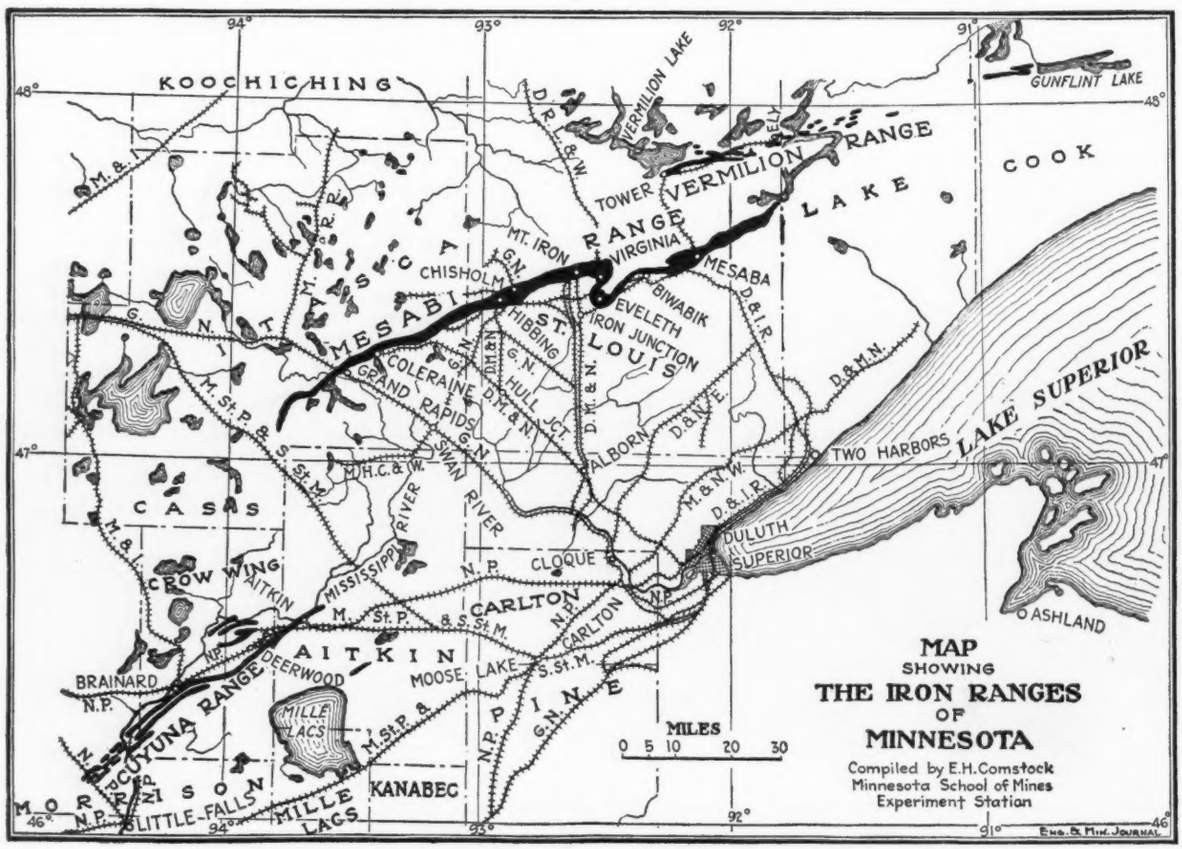

FIG. 2. MAP OF NORTHWESTERN MINNESOTA, SHOWING THE IRON RANGES

Geologic Structure—General Geology

A short statement of the general geology of the Mesabi district is a necessary introduction. The iron formation of the range has been traced by explorations from Sec. 12, T. 142 N, R. 25 W, northeastward to Birch Lake, Sec. 26, T. 61 N, R. 12 W, a distance along the strike of about 112 miles. Its width varies from ¼ to 3 miles. The topographic feature of the range is a line of fairly prominent and continuous hills north of the iron formation. These hills have been called "Giants Range" from early days.

As correlated by the U. S. Geological Survey and amended, the rock formations of the district consist of the following, arranged from the top down:

Quaternary system
Pleistocene series .....Glacial drift, 0 to 300 ft. Uncemented conglomerates.
Unconformity.
Cretaceous system
Conglomerates and shales....0 to 50 ft
Unconformity.
Paleozoic group (?)
Conglomerates or rubble ore..Fragments
Unconformity.
Algonkian system
Keweenawan series .....Great basal gabbro (Duluth gabbro) and granite, (Embarrass granite), intrusive in all lower formations.
Unconformity.
Huronian series
Upper Huronian series:
- Acid and basic intrusives.
- Virginia slate .....0 to great thickness.
- Biwabik iron formation .....760 ft.
- Pokegama quartzite.50 to 150 ft.

Unconformity.
Lower-Middle Huronian series:
- Giants Range granite (intrusive).
- Slate-graywacke-conglomerate formation (equivalent to the Ogishke conglomerate and Knife Lake slate of the Vermilion district).

Unconformity.
Archean system
Laurentian series .....Granites and porphyries.
Keewatin series .....Greenstones, green schists and porphyries.

Those familiar with the Geological Survey publications will notice that a Paleozoic group has been introduced here. Close observation by mining engineers on the range has disclosed the fact that there are on the tops of some orebodies one or possibly two conglomerates much

older than the Cretaceous. On one orebody a coarse rubble ore is found so firmly cemented that it is as difficult to break as the original taconite. It certainly is much older than Cretaceous. In another place under 50 ft. of Cretaceous shale and conglomerate is found a conglomerate much harder than the Cretaceous and of different appearance. From this evidence the Paleozoic is introduced.

For the engineer in the district it is not at all necessary to keep in mind the foregoing series and the following geological column is far simpler and entirely sufficient for practical purposes:

Glacial drift
Cretaceous shale and conglomerate.
Virginia slate (black slate).
Biwabik iron formation (ferruginous cherts, taconite, and interbedded slates with orebodies).
Pokegama quartzite (granular quartzite, quartz-slate and "flaky" sericitic quartz-slate).
Basement complex of granites, slates, conglomerates, and green-stones.

The possibility of intrusions into the iron formation should be kept in mind also.

Referring to this simplified geologic column, Fig. 4 shows a generalized cross-section and explains the relative positions of the series better than a long description could. From a commercial standpoint the Upper Huronian series, namely, the Pokegama quartzite, the Biwabik iron formation, and the Virginia slate are the important rocks of the district. This series rests unconformably upon the older rocks and slopes away from them to the south and southeast at low angles, 5° to 8°, although locally steep dips are observed. It is obvious that it consists of sedimentaries which therefore have practically parallel bedding. This fact should be emphasized and remembered. At the base of the Biwabik iron formation and resting on the Pokegama quartzite is a conglomerate varying in thickness from a few inches to 15 ft., indicating a slight unconformity. At its top the iron formation has a sharp though conformable contact with the Virginia slate. U. S. Geological Survey publications state that in places the quartzite is absent and the iron formation rests upon the older rocks. More than 300 miles of drilling by mining companies fails to reveal the absence of quartzite at any place.

The quartzite varies in different places from disintegrated, granular quartzite to a compact, granular quartzite, to an extremely fine-grained, dense quartz-slate and to a "flaky" or sericitic quartz-slate. Failure to recognize these different phases as being the true Pokegama formation has caused different explorers to drill completely through the quartzite into the underlying granite, slate or greenstone. Assays of the quartzite have run as high as 33% iron, causing the explorers to think the formation was the true taconite, the local name for the ferruginous chert of the Biwabik iron formation. This mistake always can be avoided by watching the drill cores for the gnarled jasper and conglomerate at the base of the iron formation and on top of the quartzite.

Iron Formation and Intermediate Slate

The iron formation (Fig. 6) consists principally of iron-bearing chert, called taconite, interbedded with both thin and thick layers of gray, green and black slates. Its greatest known thickness is 760 ft. From 150 ft. to 285 ft. (in rock) above the quartzite is the bottom of a main slate layer varying in thickness from 10 ft. to 50 ft., although locally it has a uniform thickness. On the eastern end of the range this distance is 150 ft. or a little more; in the central part it is 180 ft. to 285 ft., averaging about 200 ft. This slate is known as the Intermediate slate and is an important horizon in the formation, as will be shown later. Interbedded with this slate are lenses of taconite. Below the slate is a layer of taconite, yellow in color where altered, from 10 ft. to 50 ft. thick. It grades downward into true gray taconite or ferruginous chert. Its top, the contact with the Intermediate slate, is extremely sharp. Near the bottom of this yellow taconite in some parts of the district there is an interbedded conglomerate.

Above the Intermediate slate is a horizon of slaty taconite 15 ft. to 50 ft. thick, more thinly bedded than the lower yellow taconite. This is really the gradation from the Intermediate-slate layer into the upper taconite and is not sharply defined. Above this layer or horizon is a great thickness, 300 ft. to 500 ft., of "cherty" taconite, as distinguished from "slaty" taconite, in which are interbedded both thin and thick layers of gray slate, not so dark generally as the Intermediate slate. The princi-

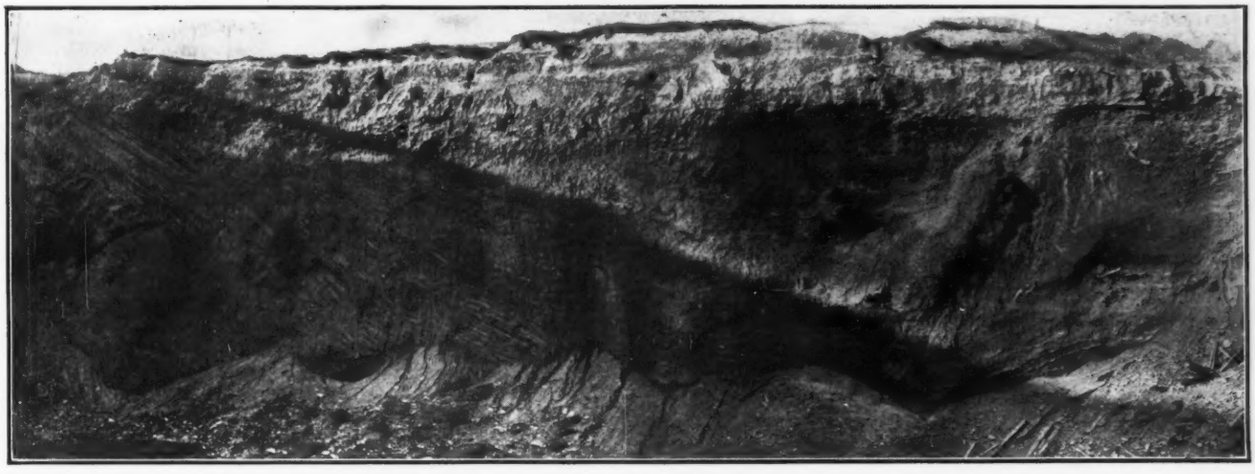

FIG. 3. FACE OF ORE AT NORTH END OF AGNEW MINE, HIBBING DISTRICT
Note the marked slump of ore layers. The orebody is a small trough tributary to a large one. At the right end is a drag fold. On top of the ore is a bed of Cretaceous conglomerate covered by drift

pal one of these slate layers is from 20 ft. to 75 ft. thick and its top is about 135 ft. to 175 ft. above the bottom of the Intermediate slate. There is danger of confusing this slate with the Intermediate slate in drill cores unless all the drill holes are correlated as drilling progresses. If the hole is put down through the Intermediate slate, the two slates will be distinguished readily because of the presence of the lower yellow taconite, usually considerably decomposed, beneath the Intermediate slate.

This slate and slaty-taconite series may be considered broadly as a slate horizon interbedded with the taconite. Its total thickness is 175 ft. or less and its lower 40 or 50 ft. usually is most distinct.

At its top the upper cherty taconite is interbedded with more slate and finally gives way to a fine black slate, the Virginia. Thus, as previously indicated, the taconite or Biwabik formation grades upward into Virginia slate, although the actual contact between the two is well defined. The interbedded slates represent periods when, due perhaps to the rising of the land area north of the shore line, the rivers became more rapid and erosion more active and increased amounts of mud were transported to the sea or lake in which the iron formation was being deposited.

In the eastern part of the district a marked conglomerate 10 to 30 ft. thick is found some distance above the top of the slate horizon just mentioned. Two distinct conglomerates are also found within the slate horizon.

An understanding of the structure just described, and illustrated in Fig. 6, is essential to the correct understanding of the structure of the orebodies to be described later, since the two are genetically related.

The source of the iron in the taconite need not be reviewed here; it is discussed at length in monographs 43 and 52. It is sufficient here to recognize the quartzite-iron-formation-slate series as an ordinary series of clastic sediments (except for the iron) deposited in fairly shallow water, contemporaneous with which an enormous quantity of iron was deposited or precipitated out of solution. It has been shown that most of the iron was originally in the form of ferrous silicate, $FeSiO_3$, occurring as minute green granules of the mineral greenalite, embedded in a matrix of chert. Iron carbonate is present in small quantities.

The iron formation probably was covered completely by the Virginia slate before earth movements caused the series to be raised above the water. When this occurred, erosion at once started, cutting through the overlying slate and exposing the iron formation and quartzite. Thus exposed to ground waters and oxidizing agencies, the ferrous iron of the iron formation became oxidized and the great mass of the iron formation was changed from a greenalite-chert rock to an iron oxide-chert rock, the present taconite or ferruginous chert. The iron oxide is in the form of minute granules (oxidized greenalite grains) and of small irregular masses and layers. This change or primary concentration must have taken an exceedingly long time. The earth movements which raised the Mesabi rocks above water also caused considerable folding, cracking and faulting of the rocks. Where cracks were numerous ground water found its way into the formation most easily. These waters, by means of the CO_2 and other solvents they carried in solution, attacked the silica in such favorable places, dissolved it to a large extent and carried it away in solution, leaving in place the stable iron oxide. This secondary concentration in favorable locations has produced the orebodies as we have them today. The process was a simple one; the leaching out of the silica left the iron oxide of the taconite in place. This removal of silica left voids or pore spaces and decreased the volume. The residual ore slumped or compacted itself of its own weight; this slump is a marked feature in almost every orebody (Fig. 3). Some further oxidization of iron probably occurred at the same time. The orebodies thus formed are of the greatest variety of size and shape. Their total known area is more than 15% of the total area of explored iron formation; their volume is a much smaller proportion. The size, shape and formation of the orebodies will be discussed at greater length in Part IV.

The average iron content of the taconite is about 26%. The average of all ores above 50% iron is between 58% and 60% dried at 212° F. The principal mineral in the ores derived from taconite is hematite; in those from slaty taconite, limonite. The alteration of the interbedded slates makes "paint-rock," a mixture of extremely fine, "powdery" hematite and limonite in a mass of soft clay.

FIG. 4. GENERALIZED CROSS-SECTION OF THE MESABI RANGE LOOKING WEST

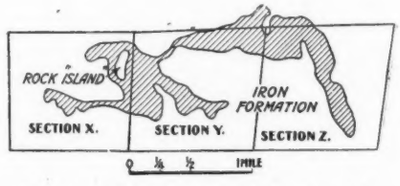

FIG. 5. TYPICAL SHAPE OF AN OREBODY

Cretaceous Conglomerate and Shale

In practically all parts of the district are found remnants of a Cretaceous series overlying unconformably the iron formation and the Virginia slate. This series consists of a basal conglomerate of coarse pebbles of iron ore several inches or several feet in thickness, grading upward through a fine conglomerate into a true shale. In some places this shale averages 50% dried iron. Shells and vertebrae and teeth recognized as those of a variety of shark, mosasaur, are found in the shale. In most places the conglomerate is poorly cemented with a siliceous-aluminous material, a true clay. Several bodies of this conglomerate 15 to 30 ft. thick, each containing several hundred thousand tons, have been found by drill explorations. They overlie the Virginia slate or the contact of slate and iron formation; in a few places they cap the other orebodies. Their content is from 50% to 54% dry iron; their alumina content is high, from 6 to 12%. Phosphorus is also notably high, due to organic remains. In preglacial erosion channels and probably old shallow lake basins on top of the iron formation, poorly assorted

uncemented conglomerates of iron-ore pebbles are found. These conglomerates are much younger than the Cretaceous.

Glacial Drift

Covering the sedimentary rocks of the district almost entirely is a mantle of glacial drift varying in thickness from a few feet to over 300 ft. The average thickness over the orebodies developed as openpits is 50 ft. As can be seen in the banks of the openpits, this drift consists of a lower and an upper layer of typical glacial till, between which is a layer of stratified sands and gravels. These latter probably were deposited in a marginal glacial lake, while the former are the ground moraine of two different ice-sheets. This complete series is not found everywhere in the district.

With the foregoing statement of the general geology of the district as a basis, the detailed structure of the orebodies may be considered.

Typical Structure

Three types of orebodies are found in the district, namely, trough bodies, flat-layered bodies and fissure bodies, named in order of their importance. These three types and the conditions of their formation will be discussed in part IV. By far the greater part of the ore occurs in trough bodies; therefore the structure of the trough bodies will be described and illustrated as the typical structure of Mesabi orebodies.

The process of formation of the orebodies as explained in the foregoing discussion developed great troughs in the iron formation, in which the orebodies lie. Some of these troughs are small and isolated, but for the most part they are connected into enormous irregularly shaped bodies. Amoeba-form is the best descriptive word for their shape in plan. Fig. 5 shows the area of such a body, The main body has a trough basin and the individual fingers or lobes each has a trough structure. The main axis of each trough is roughly parallel to the strike of the formation, but the axes of the minor troughs are at all angles to the strike. For purposes of illustration the structure of the minor troughs will be considered. Fig. 7 is a section of a minor trough taken at right angles to the longitudinal axis; it shows the typical structure of a Mesabi orebody. Fig. 6 shows the typical structure of the iron formation where unaltered to ore. A comparison of the two figures discloses at once the direct relation between the structure of the country rock or unaltered iron formation and that of the orebody. The Intermediate slate becomes intermediate paint-rock, the upper slaty taconite and lower yellow taconite become upper nonbessemer and lower nonbessemer ore layers respectively, and the upper and lower cherty taconite are altered to upper and lower high-grade (generally bessemer) orebodies, respectively. The ore of these high-grade bodies is generally referred to as blue ore, from a slightly bluish cast which it has in the bank.

Fig. 7 is an actual section of an orebody now nearly mined out, except that the width has been reduced 200 ft. in the figure. As is evident, a large thickness of the formation above the Intermediate layer has been removed by glacial and preglacial erosion. Attention is called to the marked slumping of the layers in the middle of the trough and at the contact of the ore with the rock walls. This was previously explained and, as stated, is a marked feature of Mesabi orebodies. At every rock and ore contact it is observed. The seams of ore often can be followed turning up and connecting with ore seams in the rock. In deep troughs the ore layers have slipped down many feet along the rock wall. So persistent and pronounced is this slumping that the presence of underlying rock pillars or the outline of a lower rock wall can be known quite accurately by observing the slump of the ore layers in either underground or openpit workings.

The ore of the upper high-grade body is characteristically fine grained and contains numerous seams and layers of paint-rock, resulting from the alteration of the interbedded slate seams and layers. Little rock, taconite, is found in this body. Mineralogically hematite predominates, but many of the paint-rock seams are limonite.

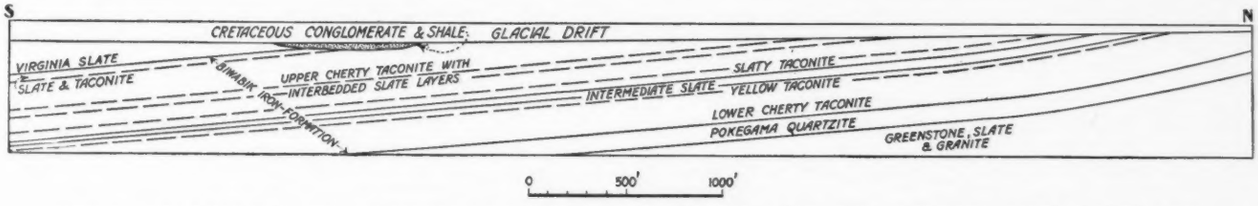

FIG. 6. GENERALIZED CROSS-SECTION OF THE MESABI RANGE, SHOWING GEOLOGIC FORMATIONS AND SUBDIVISIONS OF BIWABIK IRON FORMATION

The ore of the lower high-grade body is much coarser than that of the upper and contains but few seams of paint-rock as compared with the upper. It consists principally of hematite. Most of the lower orebodies so far developed contain considerable rock; their silica content for the same grade of iron is higher than in the upper orebody. This indicates that the alteration and concentration have not been so complete below the intermediate layer as above it. The rock occurs as layers or lenses and as pillars. If large, the pillars are called "horses" of rock or taconite islands. In some cases these rock pillars stand up like slender pyramids. In others the base is found to be altered to ore and they fall over or are blasted down in mining operations in openpits. In many orebodies the lower 10 to 25 ft. of the lower high-grade orebody is exceedingly sandy, making it really a low-grade ore. In such bodies the high-grade ore grades downward through sandy and decomposed taconite to the bottom solid taconite. In other bodies the contact of high-grade ore and bottom rock is sharp. Monograph 52 states that in no place does an orebody rest upon the quartzite. Recent drilling has shown that several orebodies in the western part of the district rest directly upon the quartzite. As early as 1906 part of the orebody of the West Gilbert mine was known to rest on the quartzite. Mining operations have shown that the top 5 ft. of the quartzite, not the conglomerate above it, is so impregnated from the ore above that it analyzes over 50% iron, dried.

The upper nonbessemer layer is an alteration of slaty taconite, is quite soft in texture and finely laminated. It is composed of layers of limonite and a little hematite, the latter occurring in the layers of purplish paint-rock.

The lower nonbessemer ore differs from the upper nonbessemer chiefly in texture. It is derived from a true taconite or chert rather than from a slate. The ore is chiefly hematite; but there are enough limonite streaks in it to give it a yellow color In texture it is nearly as coarse as is the underlying high-grade ore. Both upper and lower nonbessemer layers are called locally yellow or brown ores, from their appearance. The lower nonbessemer ore cannot in any way be considered as the alteration of the lower part of the Intermediate slate, because the break between the latter and the yellow taconite from which the lower nonbessemer ore is derived is the sharpest division in the Biwabik formation. In fact, as will be shown later, this very break is used to work out the structure of orebodies from drill records and drill cores. As previously indicated the upper nonbessemer ore is a gradation from the Intermediate paint-rock layer into the upper high-grade ore.

The Intermediate slate layer becomes altered to the Intermediate paint-rock layer in an orebody. The paint-rock is a soft, clayey layer, from 5 to 50 ft. thick. The predominating color is red, although there are numerous thin yellow, brown and purplish layers in it. It has a high moisture content and samples taken from it are exceptionally high in alumina and usually in phosphorus also, although there are local exceptions to the latter rule. The iron analyses for the paint-rock layer given in Fig. 7 cannot be compared directly with those of the yellow and blue ores because the moisture in the paint-rock is 50% to 100% more than in the blue ores. Analyses given in Fig. 7 are dried at 212° F. The paint-rock is not a commercial ore; its natural iron is too low, ranging from 35% to 43%.

The high-grade bodies have been referred to as generally bessemer orebodies. In many cases, however, the phosphorus is too high to class them as bessemer. The lower orebody is more uniformly bessemer than is the upper. This is probably due to the greater abundance of paint-rock seams in the upper body (the slates carry higher phosphorus than does the chert), and also to phosphorus precipitated out of solution from ground waters.

Since a 40-acre tract is the unit of ownership on the Mesabi range the complete typical structure does not appear in every such tract. In many places glacial and preglacial erosion has removed part or all of the upper orebody, intermediate paint-rock layer and lower nonbessemer, leaving only part of the lower orebody. In places such erosion leaves the paint-rock layer capping the orebody. In a few cases, including one exceedingly large orebody, there is no alteration below the Intermediate slate, and this layer is the foot wall of the orebody. Then there are extensive flat-layered orebodies which are below the Intermediate slate and there is little or no ore above it.

In Secs. 2 and 3, T. 58 N, R. 15 W a granite intrusion in the iron formation below the Intermediate slate forms the foot wall of the orebody of the Meadow mine.

The typical structure above described applies to the orebodies from one end of the range to the other. It was first recognized by John Uno Sebenius, now general mining engineer of the Oliver Iron Mining Co., in the early days of Mesabi exploration. He carried samples of the Intermediate slate from one part of the range to another in order to establish the continuity of this layer. He compiled the first map of the district and the map published by the U. S. Geological Survey is practically a copy of his map, which has been added to and corrected as explorations progressed. His geologic and mining work in the district make him the foremost authority on the Mesabi range. I am indebted to him for permission to use much of the information contained in these articles. I am also indebted to the officers of the Oliver Iron Mining Co. for permission to publish these articles and to use data from which they have been prepared. The great mass of information collected by them since the early exploration of the Mesabi range has been accessible and without such data the facts presented in these articles could not have been worked out. I take credit only for the close study and correlation of this information and observations in operating mines all over the range. Special acknowledgment is due also to associate engineers in the Duluth office for helpful suggestions and criticisms.

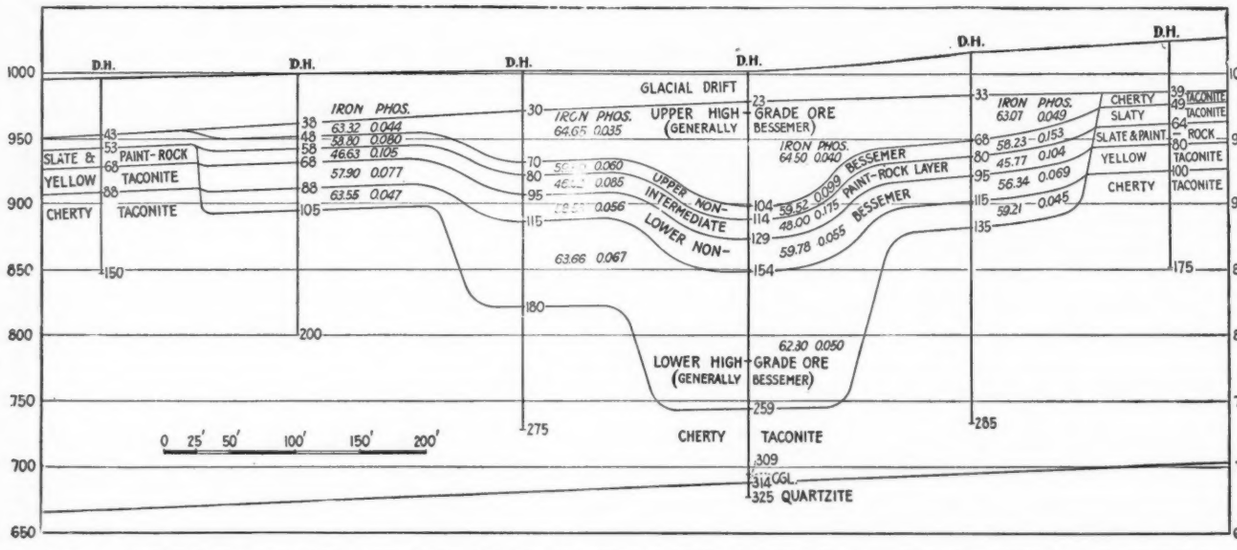

FIG. 7. CROSS-SECTION OF A TROUGH OREBODY, SHOWING TYPICAL STRUCTURE AND ANALYSES OF ORE

(To be continued)

Zinc Corporation and the War

SYNOPSIS—Besides financial tension and disturbed markets, the war closed the outlet for the Zinc Corporation's zinc concentrates which had been smelted in Germany. The chairman reports that the corporation's effort to dispose of its products was further embarrassed by the inability to get a decision from the British courts as to whether its contract with an alien enemy was merely suspended or was canceled.

The difficulties arising out of the war for Australian companies that were having their zinc concentrates smelted in Europe are set forth in an interesting address by Chairman F. A. Govett to stockholders at the recent annual meeting of the Zinc Corporation in London. The chairman said in part:

This company is one of those which has suffered very hardly with the incidence of war—a world-wide war, with all its diverse and far-reaching effects. Some companies and some individuals are making largely increased gains, while others, like ourselves, have been condemned to struggle with adverse conditions to maintain some decent profit, some even to keep alive. Not only have we had to deal with direct troubles in total suspension of our sales of zinc concentrates and in difficult markets for our lead production, but also indirectly, in that we were involved in legal difficulties in our contract with an alien enemy, while, in full and reasonable anticipation of continued peace—for who last summer thought of war, and such a war as this?—we found ourselves surprised, with our financial resources tied up, with our wealth unrealizable, even if our credit was and still is unimpaired. This position, of course, entailed, as we informed you in our circular, the postponement of the final instalment of the preference dividend, which now we pay.

When confronted by factors of sufficient magnitude and great complexity, it is fair to say that none of us are more than theorists or empirics in times like those at the beginning of the war. There was no man—banker, merchant, chancellor or financier—who could do much better than make a hesitating guess at what would happen as a result of any step; consequently, we have passed through many stages of moratorium and questionable relief, including national assumption of hundreds of millions of doubtful bills and attempts to establish here the industries of other countries with no determination to protect them till established; in fact, we have passed through a whole gamut of tentative expedients, and even now the exchanges of the world are in disorder and the financial conditions in some countries—certainly in one, in which we are financially interested, Canada—are still difficult, uncertain and confused.

Lead-Smelting Contract Suspended

I will come back to this point in dealing with our financial position, but first I must trace our history from the outbreak of the war. At that time it was in our judgment probable that while our sale of zinc concentrates was obviously totally suspended, some considerable demand for lead would be continued, and with that idea we kept our lead concentrator in full operation and closed down the zinc. That view was not shared by other people; in fact, I think we were alone in taking it, for the other mines at Broken Hill only worked half time, and that only in order to keep labor employed, while the Broken Hill Proprietary, with whom we had our contract for the sale of our lead concentrates, notified us in consequence of war of suspension of our contract. At first we were under the impression here that they must actually have stopped smelting, in which case the suspension, of course, was justified. Under this impression we issued our circular last September.

It was only later, to our intense surprise, that we found they had never ceased to work full time. Then we protested, for, as the war had not interfered with their working at Port Pirie, the war clause in the contract plainly could not apply. I do not like to suggest that they seized a very thin opportunity to rid themselves of an onerous contract, but we regard the suspension simply as outrageous. The result was that we were forced into a position of either having to put up with what we considered an illegal and unwarrantable suspension of our contract—for the group with whom they had made a working arrangement during the war would not admit us to share in the arrangement for smelting at all unless we accepted that position—or we were left with no possibility of smelting our present output, and with our sole remedy an action against the Proprietary, which, under the circumstances, would have placed us in a most invidious position. In Australia such an action would have been regarded as mean and unpatriotic, for this arrangement with the North and South was primarily an arrangement to keep labor employed, although it has turned out very profitably for those companies. We do not like law, however sure we feel; we wanted to keep our labor employed; we had to sell our concentrates, and therefore we had to put our pride in our pockets and to accept the share which they offered. We were just in a cleft stick.

Coöperative Smelting Arrangement

I am not going to reargue further before you our view of this question, but under this compulsion and our immediate necessity we accepted a four-eighteenths participation and again began to earn some revenue. But I would like to call your attention to the fact that our view of the future of lead sales was right; the demand, of course, has not been normal, but at this moment the price of lead is much higher, and the demand, I think, is going to continue. Now, however badly we may think we have been treated by the Proprietary people, I think this is going to work out "somehow good," for at least there is some sign of real concerted action in lead production and in the selling of lead from Broken Hill. While I am on this subject I may as well deal with the proposal which was before us and which we have accepted. It is this: A company has been formed of £700,000 issued capital, to take over and work the Proprietary smelting works. The purchase price is £450,000, payable as to £300,000 in cash and £150,000 in shares. It appears there is £250,000 working capital. Toward this £550,000 cash the Proprietary subscribed £50,000, which leaves £500,000 in cash to be provided. This is subscribed by the North and South and ourselves.

It is understood that this is to be regarded more as a coöperative scheme than as a commercial enterprise to pay large profits, its object being to treat the Broken Hill output as far as possible as a whole. There will always necessarily be exceptions—for instance, the Sulphide Corporation has smelting works of its own; but this is the first genuine attempt at combined operation, and we regard it as most important, for it should establish the combination in a powerful position as regards the lead markets of the world. We had, therefore, no hesitation of any sort in accepting our share in this combination. The proposal is that this company will also smelt for outside companies, the returning charge being based on a reasonable profit to provide for interest on capital and amortization. That helps to make the money involved secure, and, even if we get no extravagant dividends from our investments, we shall get the equivalent in whatever increased profit there may be in the realization of our concentrates, for the smelting company will control the operations of marketing the lead, and this is an important move in the direction of shaking free from the domination of foreign control of the metal markets of the world. Our participation was necessary, for if we did not participate we could not smelt our concentrates; no matter how we raised the money, we had to take our share, and, therefore, we did not worry you with earlier discussion of this matter.

Alien-Enemy Contracts

I now pass to the zinc position, and here there is involved the question of alien contract. Prior to the war, as indeed you know, we sold our concentrates to German buyers, who, of course, at once notified us of suspension. I think the first three months of the war was spent by H. C. Hoover and myself in a continuous study of this zinc position with a view to finding other outlets, and in consideration of the question of the erection of smelting works here, while Theodore Hoover was in America studying the position of zinc smelting there. Counsel's opinion was at once taken as to these contracts being void, and while the authorities over here seemed all agreed that the contracts actually were void, it was not a positive fact, for there had been no decision and there seemed no way to get a decision, which first was absolutely necessary, seeing the magnitude of the sums involved. We made a gallant effort to get a declaration from the Special War Court of Appeal, but when we appeared in court before six judges they pleasantly told us they could not hear the case as we had not brought the alien enemy into court. While this embarrassing and paradoxical decision may have pleased and satisfied the legal mind, it fairly blocked our road, and the only alternative before us was to wait for state declaration that such contracts are void. The Australian Federal Government appeared to be anxious to take this course, and I interviewed the High Commissioner and bombarded the Colonial Office and the Board of Trade to take joint action, but so far without effect beyond this, that a short act was passed in March making it possible to bring an alien enemy into court by substituted service, and we are now engaged in another attempt to grapple with the difficulty.

This question of the alien-enemy contract was and is of the last importance to this company, for if these contracts were not void beyond all question, but possibly only suspended, it was not open to us to build smelting works for ourselves, nor could we make other contracts, and lastly, unless happily we can get our declaration of avoidance by the act of the Federal Parliament, or by assistance of this short act of which I spoke just now, it looks as if we may be sooner or later involved in lengthy litigation and this litigation might keep us out of business for another period. So much for the legal point. It is not easy to see the present price of spelter and not to feel wild that we are not able to sell our concentrates and take advantage of the price; but one should reflect that the price exists only because we cannot sell, and that if we could the price would not be there.

Temporary Zinc-Smelting Works Impracticable

It has been suggested to us once or twice that in order to get some benefit from this abnormal price, we should run up a cheap temporary zinc smelting plant quickly. I fear the answer is that it would take a year to erect any kind of a new plant, and there is no such thing as a cheap make-shift smelting works; so that unless you think the war is going to last, that suggestion is no use, while as regards the practical point of erection of smelting works, it would be difficult here to get the labor to erect, or when erected, the skilled labor required to operate; while generally, apart from war conditions in England and Australia, frankly I doubt if this policy can be justified. There were in existence before the war even more smelting works than were required to produce the consumption of the world in spelter. To add to their number, except perhaps to a small extent by way of a "control" plant, which would enable us to compare results, would simply mean to increase the competition and depreciate the price of spelter. Before the war many of these plants in America and Holland were actually shut down, and except for patriotic desires it would not seem sense to increase the number unless it be to supply our home consumption, and this only with a full determination to protect the industry, when established, from destructive, certain competition.

These plants are expensive to erect; a plant to handle our production of concentrates alone would cost £500,000, leaving out of consideration the capital necessary to carry and finance the business. Notwithstanding these portentous figures, we spent the first three or four months of the war practically in this continuous study of the problem; we examined various sites all over England, and have had negotiations with the leading smelting people, and others, in the United States, here in London and elsewhere. The president and the engineers of one of the leading companies specially came over, but we could not agree on remunerative terms. But so far as the erection of works is in question, our conclusion is that in the absence of protection or some state assistance, our policy must be, on conclusion of the war, to make some new contract on equitable lines with some existing smelting works. This perhaps may seem a pity, for, in our group, which includes the Burma Mines, we have two mines which look like a sufficient permanent assurance of supply of zinc ore. That is one of the difficulties—the permanence of supply. That, we think, is one of the conclusive reasons why smelting works of any size cannot be erected in Australia, for as the accumulated mountains of tailings disappear—and the progress of disappearance is fast—the current supply of tailings would be insufficient to justify erection, the later supply not being assured. Be-

sides this, there would be the expense of highly paid labor, and the business would not stand it. I think that explains the position as it is likely to be at the end of the war.

Sale of Zinc Concentrates

So far as regards the present we have also had plenty of negotiations for temporary contracts, but without result. We put forward what was admitted to be a reasonable plan with one of the leading American companies, whereby both we and the purchasers could share equitably in the profit resulting from high-priced spelter, but constantly we were met with the objection that other Australian concentrates were offering on very much easier terms. As recently announced, the Amalgamated Zinc has made one small sale—I fear on not good terms—so that I can only conclude that the other companies between them previously must have all but spoiled the whole business, for the only definite terms which I have heard, and on which a contract was actually effected, were such as we should not accept. None the less, I am pleased to say we think we have succeeded in selling 14,000 tons on terms which are satisfactory to ourselves, and we have some hope that this may be followed by other sales. I am not in a position at present to say more than that, for the business is not definitely complete; still I hope that it may enable us to start working, at any rate on some reduced scale or for a time. But it would be no use estimating possible profits under present conditions.

Lead Operations Profitable

We are, however, doing well with lead, for with the present demand for lead we suppose the full production of the smelters is being sold. Against that, however, at present we are working short time, for the production of concentrates has overtaken the smelting works which will be enlarged. Before this, at £20 lead, we calculated we were making profits of about £7000 a month, while each £1 rise in price would mean about an additional £1400. But we did not like to make a monthly definite statement, as the sales of lead were very slow and we did not know that all the lead was being sold. This is the reason for the form of return adopted up till now, but for the future I think we might give some estimated profit based on a given price, say £20 a ton, leaving you to calculate the additional profit if the current market price should be maintained till realization, which, I presume, is three months forward. At the present moment, when we get it, we stand to receive a large sum of money, probably £80,000 or more, and therefore we have no hesitation in declaring the final preference dividend for 1914.

Idaho's Mineral Exhibit

The Idaho mining exhibit at the Panama-Pacific Exposition is not merely a display of ores and mineral products, but a practical, comprehensive exhibit so arranged that the visitor, with the aid of the large relief model, is able to obtain a good conception of the mining geology of the entire state. The relief model stretches across one side of the exhibit space, 60 ft. long, 50 ft. high and 15 ft. deep, forming a background for the various table displays. The model presents a series of cross-sections delineating the various vein types and fault systems within the state. The table displays embrace all the various crude ores, accompanied by the inclosing wall rocks and also the mineral products. It is all arranged by counties or districts, so that one may take up the study of the ores and rocks and products of a district or a county and, with the aid of the labeling and other printed data, quickly gain a comprehensive view of mining in Idaho.

The Cœur d'Alene display is the largest, occupying a table 60 ft. long and 4 ft. deep. This presents an interesting study of the lead-silver and zinc ores, their accompanying rocks and products. Massive pieces of lead sulphide weighing 300 to 1100 lb. from the Cœur d'Alene, and also massive pieces of zinc blende from the Interstate-Callahan mine, form an interesting and attractive feature. The lead-silver, the zinc and gray copper ores from Idaho, Bonner and Boise Counties are arranged on a separate table, thus presenting these characteristic ores so distributed that they form an instructive display and enable the visitor to make acquaintance with the situation and occurrence of this character of ores. The copper display occupies a table 27 ft. long, 5½ ft. deep and contains samples of all the copper ores produced in Idaho, including malachite, azurite, black and red oxides, native copper, disseminated copper and the porphyry ores. The gold display contains ores from Lemhi and Idaho Counties and the free-milling and sulphide ores from Owyhee, Lemhi, Idaho and Blaine Counties. Included with the gold display are samples of gold in an iron mass (limonite).

MINERAL EXHIBIT OF IDAHO AT SAN FRANCISCO

The chief attraction in the structural materials division is a massive piece of sandstone, illustrating the progress from the quarried rock to the finished product, showing in the one piece the stone as originally broken out from the quarry, a portion of it roughly dressed and another part highly polished. The figure presented by the work part of the sandstone describes one-half of an arch. There is a series of photographs illustrating interesting features of Idaho mining and also the mills of the Cœur d'Alene district. Altogether Idaho has given to exposition visitors a practical, comprehensive and sane display of the mineral resources of the state.

Pig Iron Production in the Electric Furnace is carried on successfully at Tinfos, Norway. Coke is used as the reducing material and the ore carries 44 to 47% iron. The power in the furnace is from 1200 to 1400 kw. There are four furnaces at Tinfos, three being usually in operation while one is held in reserve. The output is about nine tons per furnace per day.

Solution of Pulp Problems by Graphic Methods

By W. J. McCauley*

SYNOPSIS—Proper solution and record of pulp problems are important, but are sometimes evaded on account of the time and trouble required for the somewhat abstruse calculations. Most of the problems, however, can be formulated in such manner that their solutions can be expressed in straight-line diagrams. The methods employed are explained in detail.

In many hydrometallurgical plants the importance of making accurate pulp measurements and keeping a systematic record of them is too often overlooked. The importance of such observations can hardly be underestimated, as they are essential to the proper working of any mill. The excuse for their absence usually is that no one on the job has time to look after the work, and as the mill is apparently running pretty well as it is, there seems to be no real need of keeping such records. Most mill men will admit, however, that if such information is systematically kept through several years, it is valuable and often a money maker. The trouble encountered in the taking of such measurements and the difficult nature of the subsequent calculations are sometimes causes for inattention to such details.

Customary Use of Formulas

It is the custom in most mills where such observations and measurements are taken to first determine the constants of the ore treated—the density and such others as the practice of the mill and the systems of measurement make possible. These constants are substituted in the various formulas as one of the three factors of pulp problems. The second quantity is found by measurement and the formula is solved for the third.

It is not the purpose of this article to give methods for making pulp measurements or to derive the formulas necessary for the solution of the problems. This subject has already been thoroughly discussed.

The drudgery of solving each problem every day is eliminated by solving once all the problems concerning a certain measurement which are likely to occur in practice. Tables or curves from which the desired results of any observation may be read directly are then made. Such conveniences are somewhat difficult to formulate because to have them accurate it is necessary to solve substantially every problem within the range of the table or curve. This is usually a task of no small proportions, and should one of the previously determined constant quantities become changed at any time, the labor must all be repeated.

Graphs to Facilitate Operations

With the idea in view of rendering the making of such charts simpler I have undertaken to produce a method of graphic analysis for the solution of pulp problems, and to make a system of straight-line charts which may be drawn in a few minutes and with little or no calculation.

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The basic principles of this system were suggested in an article published by George B. McLain in the *Mining and Scientific Press,* Aug. 3, 1912. In this article the method of making and using a straight-line chart for the determination of the percentage of solution and solids in mill pulps is explained; the density of the ore being a constant and the gravity of the pulp being known.

The equations may be divided into two general classes: First, those in which it is possible to assume one quantity as constant so that when a second is made to vary by equal increments the third will also be found to vary

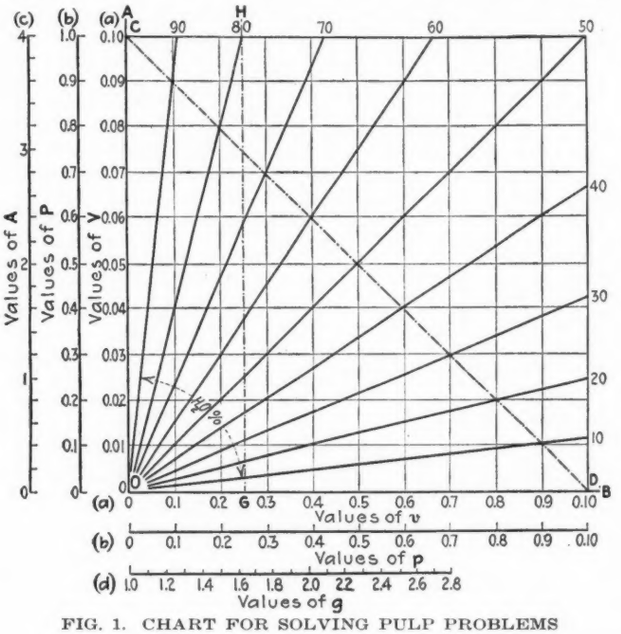


FIG. 1. CHART FOR SOLVING PULP PROBLEMS

by equal increments. Equation (1) is of this character. If in this equation either s or x is held constant it will be found that if y is varied by equal amounts, then will x or s also vary by equal amounts.

$$y = sx \qquad (1)$$

The second class consists of those equations in which the above relationship does not exist. In this case it is impossible to select any one value as constant so that if a second be varied by equal amounts the third will also vary by equal amounts. Equation (2) is of this nature.

$$y^2 = sx^2 \qquad (2)$$

The distinction between these two cases is really that of degree. The equations of the second class are formed usually not by the occurrence of the higher powers of the three variables, but by the way in which these quantities are related to one another and to the constants of the equation.

Let us now consider the nature of such equations and methods for their graphical solution, following up by some practical examples of their applications.

Formula (1) is the equation of a straight line passing through the origin, in which s is the tangent of the angle that this line makes with the axis of x. Such a problem

may be solved for all varying values of x and y, when s is a constant, by simply drawing on cross-section paper a straight line through the origin of points, which makes an angle with the axis of x whose tangent is s. A series of such lines radiating from the origin may be drawn to represent varying values of s, as in Fig. 1. All problems of this nature may now be solved by inspection of the chart.

One or two such practical pulp problems may be worked out. In explaining these charts there will be no attempt to make mathematical proofs of their correctness or the formulas used in making them.

The following symbols will be used throughout:

a = percentage of water by weight, in any pulp, expressed as a decimal.
c = a constant.
d = density of the dry pulp or ore.
g = gravity of the wet pulp.
p = number of pounds of cyanide (KCN or NaCN) per ton of solution.
P = number of pounds of cyanide per ton of solids.
R = water ratio.
t = a length of time measured in seconds.
T = tons of dry pulp discharged in 24 hr. by a pulp stream.
v = dissolved metal (Au or Ag) per ton of solution in any wet pulp.
V = Dissolved metal per ton of solids in any wet pulp.

Determination of the Dissolved Metal in Mill Tailings

The dissolved metal in discharged tailings is usually expressed as a value in cents per dry ton of pulp discharged, the value per ton of solution and the percentage of solution being known. This is accomplished by taking a sample of the tailings and determining the percentage of moisture by the gravity bottle, or other convenient method. The slime is allowed to settle from the solution and a known amount is decanted and assayed. The following formula is then employed:

$$V = \frac{av}{1 - a} \qquad (3)$$

This is of the form of equation (1). Here $s = \frac{a}{1 - a}$, and a chart, similar to the one above described, may be used.

To make this chart lay off along OB, Fig. 1, to any convenient scale, values of v, and to the same scale lay off along OA values of V. Now draw a 45° line CD and divide it into 100 equal parts. Through each of these points of division and a draw diagonal lines as shown. Number these lines from 0 to 100, starting with OB as O and ending with OA as 100. These numbers and the lines to which they are attached represent the varying percentages of water or solution in a pulp.

This method of drawing in the diagonal lines is evidently correct. In formula (3) let V and v be made to vary in such a manner that their sum is always a constant. The equation representing these changing values is $V + v = c$. This is the equation of a 45° line intersecting OA and OB in points other than O, such as CD. It will now be found that a varies by equal increments.

To use the chart, follow vertically up the line representing the value of v found by assay until it intersects the line representing the percentage of water previously determined. Thence follow horizontally to the left. On OA will be found the value of V sought.

In practice it is desirable to assay more than one assay ton of the decanted solution from the pulp, and it is usually desired to express V in terms of cents per ton. In this case it is better to lay off values of the actual weights of gold or silver found in milligrams along OB, and to lay off values in cents per ton along OA. Here CD will probably not be a 45° line, but will be one connecting two points, C and D, which have values such that

$$\frac{OD}{x} = \frac{OC}{y}$$

where x is the number of assay tons of the solution taken for assay, and y is the value in cents per ounce of gold or silver.

It sometimes happens that the pulp is too thick to make practicable the method just described of direct decantation and assaying of solution for the value of v. For notes on a method recommended in such cases, and the explanation of a chart for the calculations of same, the reader is referred to the *Engineering and Mining Journal* of Mar. 27, 1915.

Determination of Cyanide Loss

The cyanide loss in tailings is usually expressed as a number of pounds per ton of dry pulp discharged. The number of pounds per ton of solution is found by titration and the following formula applied:

$$\frac{ap}{1 - a} = P \qquad (4)$$

Formula (4) is of exactly the same nature as formula (3) and the same chart, Fig. 1, may be used for both.

It is often desired to know the water ratio of a pulp; that is, the number of tons of solution per ton of solids. The water ratio of any pulp is expressed by the formula:

$$R = \frac{a}{1 - a} \qquad (5)$$

Now, as has been shown, the quantity $\frac{a}{1 - a}$ has the value of s in the equation of a straight line passing through the origin. It is the tangent of the angle which the diagonal line makes with the axis of x, or in Fig. 1 with the line OB. Hence the water ratio is the tangent of the angle which the percentage water line makes with the line of zero percentage water, or OB of Fig. 1. This being the case we may lay off on OA values of R, and to the same scale lay off OG, on OB, equal to unity, and draw GH parallel to OA. Now the percentage water lines will cross GH on that horizontal line corresponding to the desired value of R.

A chart similar to the water ratio chart may be used to determine the number of cubic feet of solution per ton of dry pulp and many other similar problems.

Making Pulp-Stream Measurements

The tonnage measurement of pulp streams of nearly constant volume, such as tube-mill discharges, offers a considerable problem to the metallurgist. Such measurements are usually made by taking the time required for the stream to fill a given volume, such as one cubic foot. The following formula may then be applied:

$$T = \frac{2700\, d\, (g - 1)}{t\, (d - 1)} \qquad (6)$$

in which t is the time in seconds required to fill one cubic foot of volume.

For any ore d is a constant and hence the quantity $\frac{2700\,d}{d-1}$ is a constant. Once d is known for the given ore the formula becomes:

$$T = \frac{c\,(g-1)}{t} \qquad (7)$$

This equation is a rather special case of equation (1), but it can be solved by the same general methods.

Referring to Fig. 2, on OB lay off values of T to some convenient scale, starting at O as zero, and on OA lay off values of g, starting with O as the point where $g = 1$. Or, which is the same thing and practically more handy, OA may read the actual weights of the cubic-foot volume taken, starting at O with the weight of the container when full of water.

Diagonal lines, similar to those of Fig. 1, may now be drawn representing values of t, so that the horizontal line representing the value of g, or weight found, will intersect the diagonal representing the observed time of filling (t) vertically above the desired value of T.

Now if $g = 1$, T will equal zero and it follows that all the t lines intersect at O. If t is equal to zero then will T equal infinity except for the case where g is equal to unity; here T is equal to zero divided by zero which

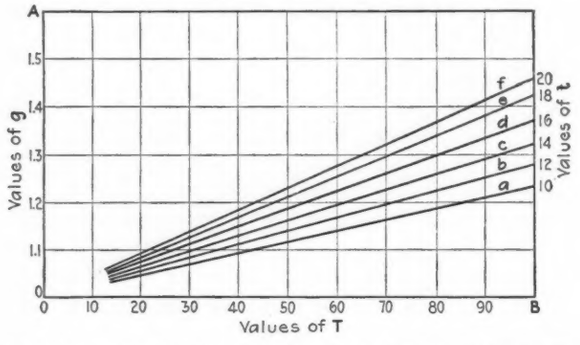


FIG. 2. CHART FOR PULP-STREAM MEASUREMENTS

is an indeterminate and may have all values from zero to infinity. Hence the line representing t equals zero and coincides with OB. If t equals infinity, then will T equal zero, and the line representing t equals infinity and coincides with OA. All other values of t are diagonals lying between OA and OB.

The t lines are all straight lines; because if t be held constant and g varied by equal increments, then will T vary by increments. If g is held constant and t is made to vary by equal amounts, then will T vary along a curve. Practically the best way to draw in the t lines is to solve the equation for each value of t liable to occur in the practice for which the chart is made, holding g constant. By this method a series of other points besides O, such as a, b, c, d, etc., on each desired t line, is found. It now only remains to draw in the t lines and number them.

In the second case the three quantities going to make up the equation bear such a relation to one another that if any one of the three quantities be held constant and a second varied by equal amounts, the third would be found to vary by unequal amounts, or along a curve. In problems of this kind it is impossible to construct a simple chart on the lines previously outlined, for we have no longer the simple equation of a straight line, but that of a curve. It may, however, be solved by a straight-line graphic method by drawing in two sets of diagonal lines, radiating from different points, so as to cross each other. These sets of lines represent two of the three values of the equation, while ordinates or abscissas represent the third. The lines representing any two of these factors meet on that point where the proper value of the third factor, necessary to balance the equation, meets them both.

There is at least one pulp problem of prime importance which falls in this class. By referring again to Fig. 1 it may be discussed.

Percentage of Water in Pulp

This problem was solved graphically in a very ingenious way by Mr. McLain. My method is similar, but in many respects the reverse of that given by McLain. My three quantities entering into this equation are a, d and g. The relationship between them is expressed by the formula:

$$a = \frac{d-g}{g\,(d-1)} \qquad (8)$$

which is evidently of the form of the second case.

On a chart constructed in accordance with Fig. 1, lay off on OB to some convenient scale, the density, d, of the ore. Let this be OF. Now on OA lay off, to the same scale, OE equal to the gravity of the solution; that is, unity as a rule. Divide OF into equal parts varying from unity at O to d at F. These divisions represent the gravities, g, of the pulps which are possible from the ore whose density is d. Draw EF. Now when g is determined by the gravity bottle or other method, the vertical line representing this value of g intersects EF at the same point as does the diagonal line representing the percentage of solution, a, sought.

This last described chart, giving the relation between a, d and g, may be made according to the method outlined only when CD is a 45° line. If the dissolved value chart be made along the line previously suggested; that is, wherein CD is not a 45° line, it is necessary that OF and OE bear a relationship different to one another than that of $OE : OF :: 1 : d$. If the chart is constructed in this manner the relationship between OF and OE will be such that

$$\frac{v}{x} = d\frac{V}{y}$$

where x and y have the same values as that assigned to them in the discussion of the dissolved value chart.

In discussing the various charts a single figure has, for the most part, been used. In the actual use of this method of analysis it is better to make individual charts for each problem to be solved; thus avoiding unnecessary lines and figures.

In what has gone before I have attempted to give the outline of a method of graphic solution of pulp problems, and explain the same by giving methods for the analysis of a few of the more commonly occurring ones. The scope of this field has only been touched; but the underlying principles of the method may be applied to nearly every pulp problem, and little difficulty should be encountered in extending them beyond the scope of this paper.

By drawing such charts to large scale and exercising care in their construction, they may be made as accurate as, or even more so than, the measurements can be taken, and fully accurate enough for all practical purposes.

American Institute Meeting at San Francisco

Elaborate arrangements have been made for the meeting of the American Institute of Mining Engineers, in San Francisco, Sept. 16-18. It will be followed by a series of excursions, which will leave those members who desire to do so free to attend the International Congress at San Francisco, Sept. 20-25. A large number of papers have already been offered for this meeting.

Several other papers of value are now under consideration by the committee, and will be distributed in advance of the meeting. The technical programs have been arranged for several simultaneous sessions on September 16 and 17, in order to allow ample time for the discussion of the various subjects.

Papers to Be Presented

The papers accepted and now in the hands of the printers follow:

Mining Methods and Law—"Fire-Fighting Methods at Mountain View Mine, Butte, Mont.," C. L. Berrien; "Underground Mining Systems of Ray Consolidated Copper Co.," Lester A. Blackner; "Mining Conditions on the Witwatersrand," W. L. Honnold; "Ore Tramming and Hoisting at the Copper Queen Mine," Gerald Sherman; "Churn-Drilling Costs, Sacramento Hill," Arthur Notman; "Application of the Apex Law at Wardner, Idaho," Fred T. Greene.

Mining Geology and Mineralogy—"Formation and Distribution of Residual Iron Ores," C. L. Dake; "Occurrence of Covellite at Butte, Mont.," A. Perry Thompson; "Formation and Distribution of Bog Iron Ores," C. L. Dake; "Geology of the Burro Mountain Copper District, New Mexico," R. E. Somers; "Additional Data on Origin of Lateritic Iron Ores of Eastern Cuba," C. K. Leith and W. J. Mead; "Method of Making Mineralogical Analysis of Sand," C. W. Tomlinson.

Milling Methods—"Kick vs. Rittinger," Arthur O. Gates; "Concentrator of the Timber Butte Milling Co., Butte, Mont.," Theodore Simons; "Hardinge Mill Data," Arthur F. Taggart.

Copper—"British Columbia Copper Co.'s Smelter, Greenwood, B. C.," Frederic K. Brunton; "Hydro-Metallurgy of Copper," L. D. Ricketts, et al.; "Hydro-Electrolytic Treatment of Copper Ores," Robert Rhea Goodrich; "Roasting and Leaching Concentrator Slimes Tailings," Lawrence Addicks.

Gold and Silver—"Metallurgical Practice in the Witwatersrand District, South Africa," F. L. Bosqui; "Mill and Cyanide Plant of Chiksan Mines, Korea," Charles W. De Witt; "Electric Furnace for Gold Refining at the Alaska-Treadwell Cyanide Plant," W. P. Lass; "Cyaniding Practice of Churchill Milling Co., Wonder, Nev.," E. E. Carpenter; "Notes on Homestake Metallurgy," Allan J. Clark; "Zinc-Dust Precipitation Tests," Nathaniel Herz; "Recovery of Mercury from Amalgamation Tailing, Buffalo Mines, Cobalt," E. B. Thornhill; "Slime Agitation and Solution Replacement Methods, West End Mill, Tonopah, Nev.," Jay A. Carpenter; "Amalgamation Tests," W. J. Sharwood; "A Rule Governing Cupellation Losses," W. J. Sharwood; "Tonopah Plant of the Belmont Milling Co.," A. H. Jones.

Lead—"The Salida Smelter," F. D. Weeks; "Lead Smelting at El Paso," H. F. Easter; "Advantages of High-Lime Slags in the Smelting of Lead Ores," S. E. Bretherton; "Mellen Rod-Casting Machine," R. C. Patterson, Jr.

Miscellaneous—"Conversion Scale for Centigrade and Fahrenheit Temperatures," Hugh P. Tiemann; "Thermal Insulation of High-Temperature Equipment," Percy A. Boeck; "Radiography of Metals," Wheeler P. Davey; "Metallurgical Industries as Possible Consumers of Electric Power," Dorsey A. Lyon and Robert M. Keeney.

Petroleum and Gas—"Gasoline from 'Synthetic' Crude Oil," Walter O. Snelling; "Correlation and Geological Structure of the Alberta Oil Fields," D. B. Dowling; "Oil, Gas, and Water Content of Dakota Sand in Canada and United States," L. G. Huntley; "Sliding Royalties for Oil and Gas Wells," Roswell H. Johnson; "Possible Occurrence of Oil and Gas Fields in Washington," Charles E. Weaver.

Iron and Steel—"Duplex Process of Steel Manufacture at the Maryland Steel Works," F. F. Lines; "The Electric Furnace in the Foundry," William G. Kranz; "Some Suggestions Regarding the Determination of the Properties of Steel," A. N. Mitinsky; "Commercial Production of Sound Homogeneous Steel Ingots and Blooms," E. Gathmann.

One of the sessions of the Institute will be a joint session with the American Electrochemical Society, at which papers of mutual interest will be presented and discussed. The Committee on Arrangements for the San Francisco meeting consists of C. W. Merrill, chairman; E. H. Benjamin, F. W. Bradley, Abbott A. Hanks, H. C. Hoover and W. C. Ralston.

The list of special excursions offered to members, from which they can make their selection, is as follows:

Sept. 18, special boat trip around San Francisco Bay, and visit to Selby Smelting Works. Sept. 18, the San Francisco high-pressure fire system, and the gas and electric works. Sept. 18, Spring Valley water works. Sept. 17 and 18, gold dredging and hydroelectric development. Sept. 18 and 19, the Grass Valley mines and hydroelectric development. Sept. 17 to 19, oil fields of Coalinga. Sept. 19, Spring Valley water works reservoirs and pumping stations. Sept. 19, the delta lands of the Sacramento and San Joaquin rivers.

Greene Cananea and Greene Consolidated

The combined reports of the Greene Cananea Copper Co. and the Greene Consolidated Copper Co., Cananea, Mexico, for 1914 show that the Greene Cananea now owns 959,378 shares of the outstanding issue of 1,000,000 shares of the Greene Consolidated. The mines and works owned and controlled by the Greene Cananea produced 21,858,920 lb. of fine copper, 907,310 oz. of silver and 6055 oz. of gold, including production from purchased ores. Dividends paid by this company aggregated $972,645. The average price received for copper was 13.8382c. per lb. during the year, and the total cost of refined copper, after deducting the value of precious metals and miscellaneous revenues, was 10.724c. per lb. This cost includes depreciation charges and all shutdown and other expenses.

A consolidated statement for the two companies shows total receipts of $3,852,998, made up of copper sales,

$2,794,140; silver sales, $471,792; gold sales, $115,741; miscellaneous revenue, $243,202; inventory of copper in process, $228,123. Charged against this revenue is $3,237,206, made up of operating expenses, $2,845,964; legal and general expenses, $41,990; taxes, $49,433; depreciation for 1914, $160,071; inventory of copper in process at Dec. 31, 1913, $139,748. The net income carried to balance sheet was $615,792. During the year $23,717 was added to fixed assets for new machinery, construction, etc. The following table gives details of tonnages treated and production:

STATEMENT, GREENE CONSOLIDATED COPPER CO.

Tonnage	
Wet tons domestic ore mined	384,690
Wet tons of domestic ore treated	383,380
Wet tons foreign ore treated	28,204
Wet tons custom ore treated	6,996
Wet tons Miami concentrates treated	21,007
Total ore treated	439,587
Wet tons domestic ore milled	147,131
Wet tons foreign ore milled	263
Ratio of concentration, tons of ore milled	3646 : 1
Production	
Returnable fine copper in bullion produced from company mines, in lb.	16,169,067
Returnable fine copper in bullion produced from Miami concentrates and foreign and custom ore, in lb.	20,269,226
Silver in domestic bullion, in oz.	636,113.62
Silver in bullion from Miami and custom ores, in oz.	180,278.39
Gold in domestic bullion, in oz.	3,136.468
Gold in bullion from Miami and custom ores, in oz.	1,132.901

Recovery from domestic ores was: Copper, 2.109%; silver, 1.659 oz.; and gold, 0.0082 oz. per ton.

Of the ore 68,000 tons was mined on contract. The total cost of mining, including this ore, was $3.09 per ton. Development work aggregated 31,859 ft. at a cost of 65c. per ton of ore mined and is included in the mining cost. The total cost of smelting new copper-bearing material to the production of converter bars, f.o.b. at Cananea, was $2.678 per ton. The net cost of refined copper was 10.613c., made up of 13.635c. for gross costs less 0.1816c. for gold and silver values and 1.206 for miscellaneous revenue.

Bolivian Copper Concentration

By F. A. Sundt*

Concentration of copper ores is carried on by the Compania Corocoro de Bolivia in a 200-ton mill by a process which is comparatively simple because of the softness and docility of the ore. The ore in question is brought from the Remedios, Capilla and San Agustin mines by means of tramway and ropeway, and is delivered to an 11x18-in. Blake breaker. In this breaker the ore is reduced to 2- or 3-in. pieces and delivered to chilean mills, where it is crushed to $\frac{1}{16}$ in. There are three of these mills, each having two rollers of granite with steel tires. Each roller is 1.5 m. in diameter, while the tire is 4 in. thick and 18 in. wide. The mills make 12.5 r.p.m. and each grinds 3 tons per hour.

From the chilean mills, which grind the ore in water, the pulp is taken to an elevating wheel 9 m. in diameter. This delivers the pulp, at a higher elevation, to a vibrating screen 2x6 ft., working at 240 strokes per min. The screen material is $\frac{1}{16}$-in. ton-cap copper wire. The oversize from the screen returns to the chilean mills for further grinding, and the undersize is taken to a hydraulic classifier of the Lake Superior type. This classifier has six spigots, which feed the three Harz jigs. The jigs have each three compartments and operate at 260 strokes per min. The screens are perforated copper plates, having apertures of $\frac{1}{8}$ and $\frac{1}{16}$ in. Middlings from the jigs are taken to the chilean mills, where they are reground, while the overflow water is used for grinding fresh ores.

Concentrates from these jigs contain about 50% copper. These are reconcentrated in another Harz jig having 280 strokes per min., the final concentrate product from which contains about 85% copper. Overflow from the hydraulic classifier goes to the table classifier, a V-shaped trough-type machine which has no hydraulic water. There are five Overstrom tables which catch practically all the copper. The overflow from the table classifier goes to waste, as also do the tailings from the tables. Middlings are elevated by a Frenier pump to another Overstrom table, where a final copper product is obtained. The middlings of this table return to the Frenier pump.

Concentrates Exported

Copper in the original ore is principally in the native state and amounts to 4 or 5%. The gangue is sandstone and there is very little clay. The concentrates produced have an average of about 85% copper, while the tailings sent to the river contain only 0.3 to 0.4%, thus making an extraction of more than 90%. The concentrates are called *barrillas,* and are put into sacks containing 50 kg., and then exported. The impurities in the concentrates consist principally of sand, and they contain but little iron and no sulphur, arsenic or other impurities, a fact which is due to the clean character of the ore. When smelted, the concentrates yield a copper which is so pure as not to require electrolytic refining.

To smelt the concentrates at Corocoro or on the coast is not economical because fuel is expensive and the export tax on copper bars is, say, 100%, while for concentrates it is only 70%. Milling is comparatively high because the cost of fuel is high and the steam plant is an old one. The company contemplates the installation of a Diesel motor plant with electrical generators. Labor is cheap, varying from 1.40 to 2 bolivianos per lift. Freight charges from Corocoro to on board the vessel at Arica is 24 bolivianos per ton of concentrates. The freight from Arica to England is now 45s. per ton.

Each of the jigs consists of three compartments, each having an area of 82x45 cm. The screens are of $\frac{1}{8}$-in. copper plate with perforations $\frac{1}{8}$ and $\frac{1}{16}$ in. diameter, and they last about 120 days. The bed of the jig is self-made and is 4 in. deep. Concentrates discharge through the screen, while the middlings go to the chilean mills. The length of stroke on these jigs is 5 to 15 mm., and the number of strokes 260 to 300 per min. The hutch product of the third compartment of the jig is low grade and is returned to the same jig for reworking. Classifying for the tables is done in a classifier 4800 mm. long with six spigots. It is 720 mm. wide at the head and 540 mm. at the end and its height is 1400 mm. The angle of the bottom is 60° and the spigots are 1 in. diameter. Its capacity is 200 tons per day of 24 hr. Water for the mill is supplied by a 4-in. centrifugal pump elevating 4 m. The elevator wheel is 9 m. in diameter, has 48 buckets and revolves at 2 r.p.m., average speed.

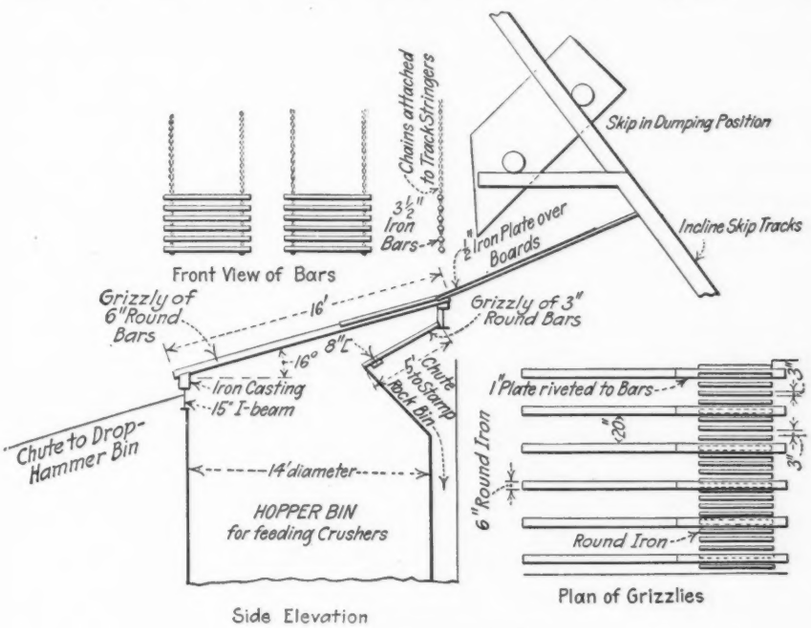
*Manager, Cia. Corocoro de Bolivia, Corocoro, Bolivia.

Details of Practical Mining

Quincy Dump and Grizzlies

By L. Hall Goodwin*

In the Lake Superior copper district it is the custom to break the rock big in the stopes; the sizes sent to the surface range up to the maximum jaw-opening of the crusher, which is generally 24x36 in., or even larger. These large boulders are reduced to about 4-in. maximum size in the rockhouse. The usual practice is to dump the contents of the skip on a heavy iron dumping plate, from which the rock passes over a single set of grizzly screens to remove 4-in. undersize before it is fed to the crusher. The Quincy mine has modified this method in several ways, the principal object being to separate the largest boulders from the rest of the rock. I outlined its practice briefly in a paper describing the rockhouse methods of the company appearing in the *Journal* June 19 and 26 and July 3 and 10, 1915. A more detailed description follows, with a sketch of the dump and grizzlies.



QUINCY DUMP AND GRIZZLIES

The rock from the dumping skip strikes a battery of 3½-in. round iron bars horizontally suspended in front of the dump from chains attached to the track stringers. There are two of these batteries, one for each skip; they serve to deflect the rock downward upon the grizzlies and to spread it evenly over them. Two sets of grizzlies are used. The first one consists of 6-in. round iron bars, 16 ft. long and inclined at 16°, having 20-in. spaces. This allows the larger boulders of copper rock and mass copper to pass over to a bin in front of the drop hammer used to break them before they are fed to the crusher, and the mass copper to be cleaned. The second grizzly set below consists of 3-in. round iron bars, 5 ft. long, inclined at 30°, having 3-in. spaces. The undersize which goes through this grizzly passes directly to the stamp-rock bin; the oversize passes to the hopper bin in front of the crushers. The dump and grizzlies are located high above the crusher floor, as they must be above the hopper bin. They are sided by iron plates 3 ft. high and above this is sheet iron to prevent flying rocks from injuring the men on the crusher floor.

*Assistant with Allen H. Rogers, 201 Devonshire St., Boston, Mass.

The Advantage of Tamping

Exhaustive tests by the Bureau of Mines as to the efficacy of stemming on the effect of explosives have proved conclusively that confinement of the charge in the hole by the use of some inert substance on top increases its efficiency to a marked degree. The Bureau chooses to use the word "stemming" in place of the term "tamping," so commonly used, to differentiate the latter from the name of the operation of placing the stemming. In other words the Bureau favors the adoption of tamping the stemming in the hole. There is always a certain amount of opposition among miners to tamping a hole and some very prominent mining engineers question the advisability of so doing. It is probable, however, that the data on which they formed these conclusions were not carefully and exhaustively drawn.

Tamping a hole has the same effect as putting a wad in a shot-gun shell or inserting the bullet in a rifle cartridge and is easily determined. For instance, take two ordinary rifle cartridges and crowd the bullet $\frac{1}{16}$ in. nearer the base in one than in the other. Then fire the two. The "kick" against the shoulder will readily demonstrate the appreciable difference between the loose and the tight tamping of the powder charge. The same thing happens on a much larger scale when confining the explosive in a drill hole, and the kick of the explosive against the rock to be broken is much increased by close tamping in the throat of the hole.

Safety First in Reloading a Hole

It is not uncommon practice among miners who return soon after a blast to the heading to see the result of their round, and who find a hole which has not broken properly, to reload immediately and shoot it over. This is dangerous practice unless the hole is filled with water and thoroughly cooled, or unless a sufficient time is allowed

to elapse in order to effect the same cooling by air. Instances have been known where a miner loading a hole with gelatin without observing these precautions was blown to atoms through the ignition of the explosive by the heat remaining in the rock.

Mine Messhouse Operation

The mine messhouse is a troublesome adjunct to a mining operation. It is rarely given the attention it deserves, and except for providing good food it is left to take care of itself. Accurate data and details of messhouse operation are therefore of value.

The Arrowrock dam was constructed in Idaho by the United States Reclamation Service under conditions sufficiently resembling mining operations to make the figures for messhouse operations, published in *Engineering News*, June 24, worth while for the mining engineer.

A sufficient charge is made against messhouse operations each month for rental to absorb the cost of messhouse building during the time of construction. A monthly charge is also made to cover depreciation of equipment.

It is very necessary that a careful record of cost be kept and reports prepared each month to show the results accomplished. The principal items of cost should be classified, so that they may be compared from month to month. The following cost-accounts have been used in connection with the messhouse operations at Arrowrock: Labor, cooks and helpers; labor, miscellaneous; subsistence; supplies; utensils; rental; fuel; lights; depreciation of equipment; general and overhead expense.

After the mess has been operated for a sufficient length of time certain standards of cost will be established, and effort can then be made by watching the cost reports to maintain these standards.

From data kept under this classification it is possible to prepare at the end of the month cost reports in the following form:

FIELD REPORT OF MESSHOUSE OPERATIONS AT MAIN MESS, ARROWROCK, SEPTEMBER, 1914

Debits		Account Nos. 730 to 739	Credits	
Inventory:			Collections:	
Subsistence	$533.46		Cash	$135.40	
Supplies	26.22		Coupons	96.00	
Utensils	1500.00	$2,059.68	Meal tickets		$231.40
Received during month:			Deducted on timebooks:		
Subsistence	8134.89		Arrowrock	10,479.25	
Supplies	344.71		B. & A. Ry.	598.50	11,077.75
Utensils	35.52	8,515.12			
Labor:					
Cooks and helpers	1559.10		Deductions on disability claims	12.75	12.75
Miscellaneous	21.50	1,580.60			
Miscellaneous expenses:			Miscellaneous credits:		
Rental	160.00		Meals served to hospital patients	173.80	173.80
Fuel	247.50				
Lights	15.00				
Depreciation on equipment	50.00	472.50			
			Inventory:		
			Subsistence	788.49	
			Supplies	26.15	
			Utensils	1,350.00	2,164.64
Profit		1,032.44			
Total		13,660.34	Total		13,660.34
Total cost for month		$10,463.26	Total number men, days		16,249
Total number of meals furnished		48,748	Unit cost per man, day		$0.644
Unit cost per meal		$0.215	Labor cost per man, day		.097
Pounds of meat used		21,471	Supplies cost per man, day		.021
Pounds meat used per man, day		1.3	Misc. exp. cost per man, day		.041
			Gen. exp. cost per man, day		.000
			Subsistence cost per man, day		.485

This is on a scale much larger than that appertaining to the usual mine boarding house, so that the cost per man per day of 48.5c. is much lower than the average cost at a mine where the usual charge is $1 per man per day and where the manager is reasonably satisfied if his boarding house breaks even at the end of a year.

Another innovation at a messhouse of this kind was in the use of small tables and serving food in family style—that is, all food is on the table at the time the meal is called. At Arrowrock small tables accommodating eight persons are provided, as this number may be served from one set of dish-ups. With this method one waiter can attend to five tables of eight persons each in an efficient manner. These small tables have been found to be a decided improvement over the long tables commonly used in construction camps.

Sinking Shoe for Soft Ground*

The sinking shoe shown in Fig. 1 was recently used in sinking a shaft in soft ground on the Mesabi Range. In operation, the dirt along the shoe was removed from the inside and the shoe jacked down until sufficient room had been gained for a set of timbers. While this shoe set was a success, it was evident that its design could be improved. As the shoe set was made of the same size as the shaft set, the ground excavated did not give the space required for the lagging. The open space between the shoe set and the last shaft set was unsupported, and to hold the ground it was necessary to drive short spiling. The corner construction was weak, and the wall plates of the set tended to turn over under the pressure from the jacks.

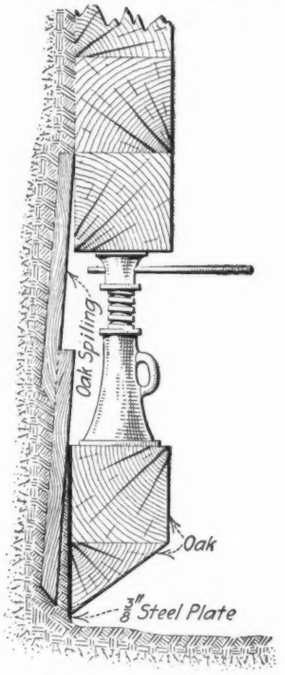


FIG. 1. SECTION THROUGH OLD SHOE

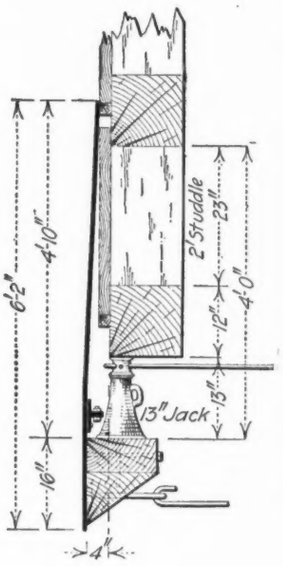


FIG. 2. SECTION THROUGH NEW SHOE

To remedy these defects, an improved sinking shoe was designed, as shown in Figs. 2 and 3. The method of operation is the same, but the set is much heavier; the corner construction has been strengthened; tight rods at

*"The Wisconsin Engineer," April, 1915.

the end correct the tendency to overturn under the jack pressure, and the shoe is 4 in. larger all around than the regulation set, which gives plenty of room for putting in the lagging or lath. Attached to the cutting plate are

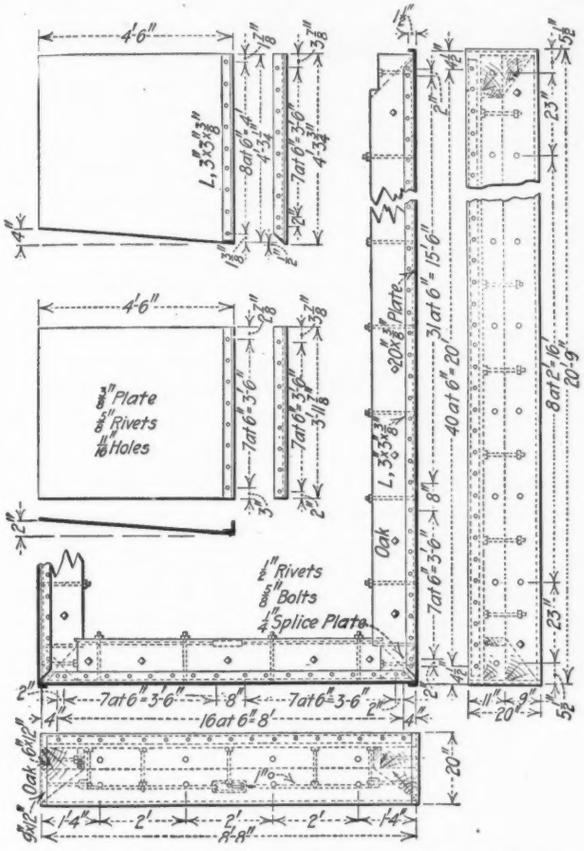


FIG. 3. DETAILS OF NEW STEEL SINKING SHOE

side plates of ⅜-in. steel, long enough to permit installing a full set of timbers with 2-ft. studdles.

This shoe gave perfect satisfaction under the conditions for which it was designed.

Jackhamer Drifting

At the Colby iron mine, Bessemer, Mich., drifting is done by use of Jackhamer auger machines, using two men for one machine. These two men do only the drilling and are followed by a blasting gang and a tramming gang for each drift of the six different headings where this system is used. The size of the drift outside of timber is 8x9 ft. During the period in question 2547 ft. of drifting was accomplished in 112 shifts, which is equivalent to 11.3 ft. per man per shift. The costs per foot are as follows:

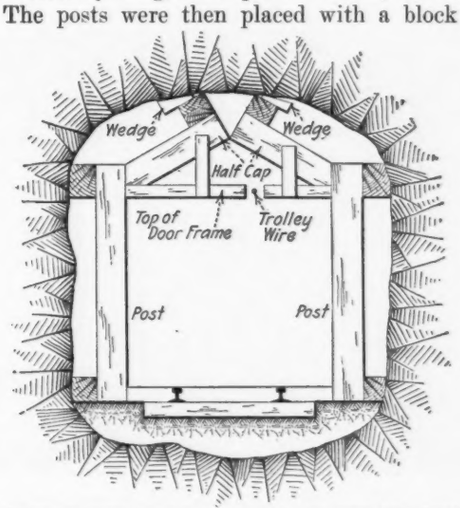
LABOR		
Miners	$0.412	
Trammers	.990	
Timbermen	.360	
Trackmen	.121	
Blasters	.116	
		$1.999
SUPPLIES		
Lagging	$0.094	
Timber	.210	
Explosives	.330	
Light, steel, shop labor, etc.	.060	
		.694
Total		$2.693

The foregoing figures include cost of breaking the ore, tramming it to the chute, timbering the drift, laying track and necessary supplies for the same except the cost of rails.

Timbering for Air-Check Doors in a Motor-Haulage Drift

By Frank S. Crawford*

In the Calumet & Arizona Mining Co.'s mines there are places where the natural air current is so strong that it was decided to place air-check doors to direct the air current into some of the hot, badly ventilated stopes. One of these doors was placed in a motor drift. The frame of the door had to be made so as to allow free passage for the trolley and the trolley wire. To accomplish this the top of the frame was made in two pieces. The posts had to be blocked out securely against the ground, and as it was not desirable to put in an extra cap above, with the necessity of longer posts and the taking down of more ground, the problem was solved by taking two pieces of square timber cut with a bevel on the ends to fit against the tops of the posts and form an arch. The bevel on the ends joining each other was such as to leave a small opening, a couple of inches, on the upper side. The posts were then placed with a block behind



TIMBER SET PLACED FOR AIR-CHECK DOOR

each to hold them in place out from the ground. The two pieces were then set in place and wedges and blocking driven in above to force them down from the roof, causing the gap to close between the ends and forcing the posts tightly against the ground.

These spreaders served to support the top of the door frame rigidly and allowed space for the trolley wire to play up and down.

A "cousin-jack" miner ran it and said, "Blawst me, it looks like a bloomin' 'ouse."

Mine Accidents in Arizona

During the year ended Dec. 1, 1914, there were, according to the 1914 annual report of the State Mine Inspector, 62 fatal accidents at the Arizona mines, which is at the rate of 6.6 fatal accidents per 1000 men employed. There were 758 serious and minor accidents, which is at the rate of 80.6 per 1000 men employed.

*Lowell Station, Bisbee, Ariz.

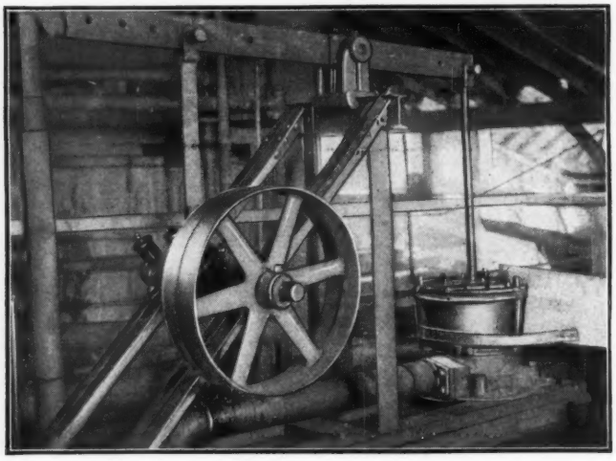
Details of Milling and Smelting

Diaphragm Pumps for Slimes

By Jesse Simmons*

With the adoption of Dorr thickeners and the counter-current system of continuous decantation, mill superintendents were forced to accomplish the economical handling of slimes. At first air lifts were almost universally used. Some installations of centrifugal pumps were made, but most operators now install diaphragm pumps. The chief objection to these pumps seems to be that the manufacturers have not studied the application of their goods to the uses to which they are now put and invariably send out a pump with the drive and gearing close-coupled. Spattering slimes cause excessive wear on the gears and pinions, necessitating large repair bills and entailing a consequent loss of service.

Of many means of overcoming this difficulty, the illustration, which shows the type of drive developed at



COUPLING METHOD FOR DIAPHRAGM PUMPS

the Golden Reward mill, at Deadwood, S. D., is one of the most noteworthy. The frame is made of light angle-iron and I-beams, with a jackshaft at one end about 5 ft. from the pump and far enough away to escape the spatterings of slimes. This shaft is belt-driven. Attached to it is an eccentric which drives a walking-beam that operates the pump. The whole mechanism rests on a bed composed of a rectangular frame of 4x6-in. timbers.

*Mining engineer, Deadwood, S. D.

Potassium Permanganate as a Cyanicide

In some recent tests made on the action of potassium permanganate as a cyanicide (abstracted by the *Journal* of the Society of Chemical Industry from the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa) normal solution from a sand-filling plant, containing 0.0013% of potassium cyanide and 0.0015% of potassium sulphocyanide, was treated, as were also solutions of sodium cyanide (strength equivalent to 0.2% of potassium cyanide), sodium thiocyanate of the same strength, and sodium-zinc cyanide of the same strength. The first three solutions were considerably affected by the permanganate, but the reaction was still incomplete after four days. Sodium-zinc cyanide, which is present in large proportions in working solution, appeared to be only slightly, if at all, affected by the permanganate after four days' contact.

Vogt Process of Recovering Rare Elements

A new process which relates to the recovery of rare elements, particularly radium, uranium and vanadium, from ores such as carnotite ore, is that invented by Louis F. Vogt (U. S. pat. 1,129,029). In following out this process the ore is first concentrated according to any approved manner, or if of a suitable character it may be merely ground. The ground ore is then roasted in the presence of salt and steam, the latter being employed for oxidizing purposes. It is then leached with water to remove the greater part of the vanadium content. A small amount of sodium carbonate is added to the water to convert any possible radium or barium chloride to the carbonate form and prevent the formation of radium or barium in soluble form in the sodium-vanadate solution.

The remaining ore from this leaching treatment is then leached with some acid, principally sulphuric, to recover the uranium and such vanadium as may remain. If other than sulphuric acid is used, sufficient sulphuric acid must be added to form an insoluble radium sulphate, and thus prevent the radium content of the ore from going into the solution. At this stage the remaining solids contain insoluble radium and barium salts and the liquor contains uranium and vanadium salts and impurities in solution.

The liquor is neutralized with sufficient sodium carbonate to precipitate such impurities as iron, alumina, silica, etc., together with most of the uranium and vanadium. If the solution contains impurities in sufficiently large quantity, all of the uranium and vanadium content will be precipitated.

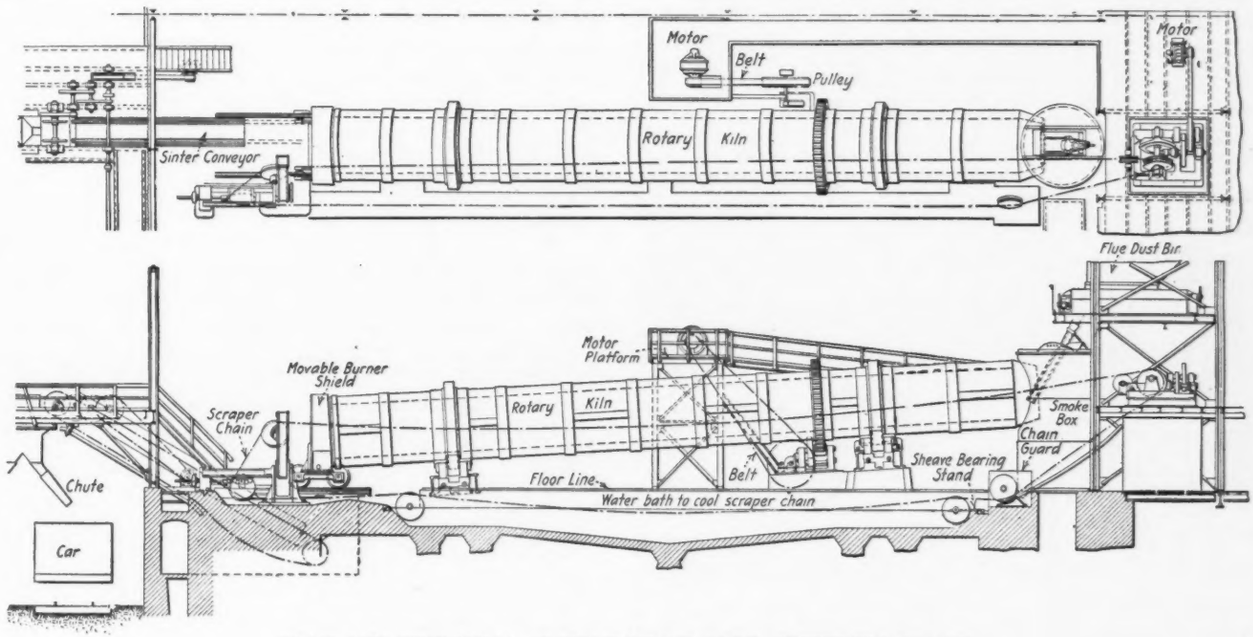
To the solution and precipitate resulting from the neutralizing step an excess of sodium carbonate is added and the mixture boiled, to leach out the uranium and vanadium contained in precipitate, leaving only the impurities. The solution is separated by filtering and is treated to recover the uranium and vanadium. Boiling with a lead salt forms lead vanadate, and the remaining solution is boiled with sufficient sodium hydrate to completely precipitate uranium as sodium uranate.

The solid ore residue is then washed, filtered, dried, fluxed with sodium carbonate and fused. The resulting matte, containing carbonate of radium, barium, iron, lime, etc., is treated with water and agitated, taking out the soluble carbonates and leaving the insoluble ones. After filtering, the insoluble carbonates are washed with

water to remove any remaining sodium silicate and free alkali. The carbonate mixture is then treated with a mineral acid, preferably hydrochloric, to dissolve the carbonates, and then by adding sulphuric acid, radium and barium sulphates are precipitated. The dried sulphates of radium and barium are thoroughly mixed with fine coke and a suitable chloride and roasted. The roasted mixture is leached to dissolve the chloride, leaving radium and barium chloride in the solution. Uranium is separated from the barium and impurities by systematic fractional crystallization.

New Sintering Plant at Gary

The new plant for sintering flue dust at Gary, Ind., has a capacity to treat the dust from 12 iron blast furnaces. At present, however, there are only eight stacks at Gary. The sintering plant now comprises two rotary inclined kilns, 90 ft. long by 9 ft. in diameter, a 12-in. brick lining



PLAN AND SECTIONAL ELEVATION OF GARY SINTERING PLANT

reducing the effective inside diameter of the kiln to 7 ft. The accompanying drawing, reproduced from *Iron Age* of May 27, 1915, shows one of the sintering kilns in plan and cross-section. The steel shell is made of $\frac{11}{16}$-in. plate with butt seams, quadruple-riveted. Each kiln is fitted with two annular bearing rings and mounted on idler rollers. The kiln is rotated at about 1 r.p.m. by means of an annular gear near the upper bearing ring, power being supplied from a 60-hp. motor placed on an overhead platform. The motor runs at 715 r.p.m., but this speed is reduced by means of a belt-drive and bevel gears which drive the pinion that engages the annular gear on the kiln.

At the lower end of the kiln is a movable burner shield, mounted on trucks so that it may be drawn back from the mouth of the kiln when not in service. The kiln will be gas-fired, gas being obtained from the nearby coke ovens of the Gary plant.

An interesting feature of the kilns is the drag-scraper chain which passes through the kiln from end to end, returning below the kiln through a bosh, for cooling. The chain has an approximate speed of 70 ft. per min., and is expected to loosen material which may stick or hang in the kiln, keep it moving toward the discharge end and thus prevent the formation of accretions within the kiln.

The flue-dust is frequently handled, owing evidently to the necessity for storage. It is brought to the plant in hopper-bottom cars, and deposited into steel-and-concrete track hoppers. From these hoppers the dust is fed by screw conveyors to a bucket elevator, which carries it up to the overhead hopper at the end of the kiln house. The dust then passes by gravity to a revolving screen having 1-in. mesh and into either of two 230-ton cylindrical bins. From these steel storage bins, another motor-driven screw conveyor feeds the dust directly into the kiln, the speed of the conveyor being under close control.

The flue dust works its way down through the kiln toward the firing end and encounters the zone of greatest heat a short distance in front of the discharge end. The sinter drops through a floor-grating on an inclined conveyor, which elevates it into hoppers immediately above the loading track. Each hopper has two delivery spouts so that the sinter may be discharged into cars on two tracks. Sprays are provided for cooling the sinter as it drops into the cars.

Making Arsenic Compounds

A process for making arsenic acid has been patented by George P. Fuller, of Niagara Falls, assigned to the National Electrolytic Co. This consists of subjecting a suspension of arsenious oxide in an aqueous solution of an alkali-metal halide to electrolysis. The anode must be insoluble and therefore platinum is usually employed. The cathode is best made of copper, although cathodes of other metals may be employed. Since the ordinary form in which arsenic is employed in the arts is as sodium arsenate, it is best to make the alkaline halide a sodium-chloride solution; otherwise the final removal of the arsenic salt will be impracticable, owing to the difficulty of separating sodium from any other base.

The Cost of Doing Things

Drilling Costs in Potash Prospecting

By E. E. Free*

During the summers of 1912, 1913 and 1914 the Railroad Valley Co. of Tonopah, Nev., carried out an extensive prospecting campaign for potash deposits in various parts of the Great Basin and especially in Railroad Valley, Nye County, Nevada. In that vicinity the existence of a buried saline body was suspected, and the prospecting took the form of drill holes designed to reach and explore the supposed saline horizon. Five of these holes were located on the mud flat or *playa* left by the ancient lake which once occupied the valley, and these five holes were sufficiently alike in materials penetrated and in general conditions to be possible of discussion together. Although the general conditions surrounding the work were somewhat unusual, it is possible that the cost data of the accompanying table may have some general interest. The prospecting proved negative, so far as potash is concerned, and has been discontinued.

COST DATA OF PROSPECT DRILLING

Hole number	2	3	4	5	6	Total	Average
Feet in clay	780	770	762	795	906	4013	803
Feet in gaylussite	63	none	none	none	84	147	...
Total depth, feet	843	770	762	795	990	4160	820
Days moving and setting up	18	13	9	10	13	63	12.6
Days drilling	6	10	5	5	10	36	7.2
Total time, days	24	23	14	15	23	99	19.8
Moving costs							
Labor	$440.60	$340.20	$239.70	$150.75	$292.85	$1464.10	$292.82
Team	633.40	103.90	106.00	16.00	76.92	936.22	187.24
Total	$1174.00	$444.10	$345.70	$166.75	$269.77	$2400.32	$480.06
Water supply costs							
Labor	$521.15	$561.02	$284.90	$133.90	$124.45	$1625.42	$325.08
Team	19.50	.....	.....	.....	.....	19.50	3.90
Total	$540.65	$561.02	$284.90	$133.90	$124.45	$1644.92	$328.98
Drilling costs							
Labor	$604.10	$747.30	$243.00	$340.70	$540.55	$2475.65	$495.13
Fuel	537.25	246.25	264.50	214.35	431.75	1694.10	338.82
Casing	20.70	24.84	27.60	27.60	26.22	126.96	25.39
Total	$1162.05	$1018.39	$535.10	$582.65	$998.52	$4296.71	$859.34
General expense							
Supplies and repairs	$146.81	$140.70	$85.65	$91.76	$140.70	$605.62	$121.12
Camp maintenance	163.25	156.45	95.23	102.04	156.45	673.42	134.68
Boarding-house deficit	95.07	91.11	55.45	59.42	91.11	392.16	78.43
Communications	325.84	312.24	190.06	203.64	312.24	1344.02	268.80
Superintendence	312.00	299.00	182.00	195.00	299.00	1287.00	257.40
Chemical work	313.40	300.33	182.81	195.88	300.33	1292.75	258.55
Liability insurance	21.33	20.45	12.44	13.33	20.45	88.00	17.60
Total	$1377.70	$1320.28	$803.64	$861.07	$1320.28	$5682.97	$1136.59
Total costs	$4254.40	$3343.79	$1969.34	$1744.37	$2713.02	$14,024.92	$2804.98
Cost per foot, total	$5.047	$4.343	$2.584	$2.194	$2.740		$3.371
Cost per foot, drilling only	1.378	1.323	.702	.733	1.009		1.033

The work here reported was done between June 20 and Nov. 10, 1913, but during this period there were two shutdowns aggregating 45 days, leaving a total of 99 days' actual work. Field operations were in charge of D. H. Walker, superintendent of the Railroad Valley Co.

Railroad Valley is southeast of the center of Nevada in a sparsely settled desert country without towns, railroads or other facilities. All supplies for the work were hauled by wagon or auto truck from Tonopah, 120 miles west, or from Ely, 75 miles northeast. Drilling was by the rotary jetting method, using an American Well Works rotary attached to a steam-driven Keystone portable rig No. 5. Water circulation was maintained by two American Well Works steam pumps supplied by a separate boiler. The entire outfit was already in the possession of the company and cost approximately $7000, including drill rod, all tools and general equipment, also camp equipment consisting of four tents, boarding house, office, wagons, water tank, etc. No depreciation or interest on this equipment has been included in the costs given. The holes were 5½ in. in diameter and were not cased except for 20 to 50 ft. at the top.

The materials penetrated were essentially the same in all five holes. The upper portions were in smooth clays with little or no sand. The hardness was somewhat variable and a few cemented layers were encountered, but never of such induration as to create serious obstacles to drilling. In their lower portions holes No. 2 and No. 6 encountered beds of solid, crystalline gaylussite[1] alternating with beds of clay. The crystalline material was fairly hard and drilled like soft sandstone or shale. Similar beds were encountered but not entered by hole No. 4. The thicknesses of the beds penetrated by the individual holes are given in the table.

The analysis of costs given in the table requires a word of explanation. "Moving" includes the cost of transporting the rig and equipment to the site of the hole, setting up, and preparing for drilling. In the case of hole No. 2 this item covers the cost of moving the rig tc the mud flat from a former location a few miles north. The expense of this first moving was much increased by continuous bad weather. Water supply for drilling and for the boilers was a matter of extreme diffi-

*Chemical engineer, 1105 Madison Ave., Baltimore, Md.

[1]The mineral gaylussite is the hydrous double carbonate of sodium and calcium (Na_2CO_3 $CaCO_3$ $5H_2O$). It is a member of the saline series for which search was being made. For details concerning the occurrence see Free, "Min. and Sci. Press," Aug. 2, 1913.

culty. No water was available at or near the drill sites and preliminary 100-ft. holes had proven dry. When a preliminary 250-ft. hole (sunk with hauled water) at the site of hole No. 2 also proved dry, it was decided to bring water by ditch from an artesian well seven miles north. Water supplied by this ditch was used for all subsequent holes. In the table the item of water-supply for hole No. 2 includes the cost of the main ditch and of all preliminary work. For the other holes only the cost of ditch maintenance and of necessary extensions is included. The cost for hole No. 3 is high because the extension of the ditch to it had to be carried through a sand ridge nearly a half-mile wide and several feet high.

The item of drilling includes the actual cost of drilling only. The usual crew was: One driller, one helper, one fireman and one sampler. Occasionally two helpers were needed. Usually there were two drilling shifts of ten hours each, the firemen working three 8-hr. shifts and looking to the pumps during the 4-hr. shutdown. For a part of hole No. 2 three 8-hr. drilling shifts were used. In addition, one or two men were employed on repairs and general mechanical work and one to three teamsters were hauling drinking water and supplies and keeping the ditch in order. The wage scale was $6.50 to $5 for drillers and $5 and $4.50 for helpers, fireman and teamsters, all on the basis of an 8-hr. day with pay for overtime at the same rate. Lodging in tents was furnished free. The boarding house was run by the company and a charge of $1 per day was made for board. The deficit on the boarding house appears under general expense in the table. Teams were hired at $7 per day for team and driver and $5 per day for extra teams, not found. Fuel was wood, no other being available at reasonable cost. It consisted largely of scrub pine and juniper, and was cut and delivered by contract at from $10.50 to $12 per cord.

General expense includes all items which extended over the whole work and cannot be assigned with accuracy to the different holes. These items have been totaled and the total divided between the holes on the basis of the working time for each hole. The item for communications includes the maintenance of the company's automobiles and the hire of other automobiles when necessary. The employer's liability insurance is that required by the law of Nevada. The item for chemical work covers the cost of an accurate chemical control of the drilling, this being necessitated by the object of the work. It includes the salary of a chemist at $7 per day and the expense of the field laboratory. The laboratory equipment was borrowed from the general laboratory of the company and is not charged for. It would have cost about $300 to duplicate it.

Smelting Costs at Greenwood, B. C.

In connection with a description of the smelting plant of the British Columbia Copper Co., at Greenwood, B. C., Frederic K. Brunton, who was assistant superintendent prior to the shutdown in 1914, gives[1] some operating costs at this plant which smelted the lowest-grade copper ore of all American works. The plant comprises three blast furnaces—two 51x360 in. at the tuyeres and the other 51x240 in.—and two converting stands using 84x126-in. acid-lined shells. The furnaces smelted daily about 2250 tons (6.62 tons per sq.ft. of hearth area) of ore carrying 0.85% Cu; the coke used varies between 12 and 14% of the charge.

In a month when three furnaces were running and the average smelted daily in the plant was 2224.2 tons, the following operating costs were attained—these do not include overhead, depreciation nor insurance:

COSTS PER TON OF ORE SMELTED TO MATTE*

Coke	$0.851
Flux	.114
Labor	.15
Power	.033
Supplies	.03
	$1.178

Cost of coke per ton f.o.b. works bins	$6.00
Cost of flux per ton f.o.b. works bins	2.75
Cost of power per kilowatt-hour	.0065

*The furnaces were slowed up with an excess of silica on the charge because of shortage of ore, smelting only 6.55 tons per sq.ft. of hearth area as against 6.66 tons per sq.ft. when the cost of smelting was $1.084.

The working costs for turning a ton of ore into blister copper during this month amounted to $1.23. There was an average of 125 men employed and the tons handled per man-day amounted to 17.8. The cost and distribution of labor throughout the plant are shown below. The payroll amounted to $12,496 for the month in question.

LABOR COSTS AT GREENWOOD PLANT

	Labor Cost per Ton of Ore Handled
Sample mill	$0.00462
Bins	.01060
Briquette mill*	.00546
Furnaces	.0958
Slag disposal	.0206
Converters	.0147
Linings	.0078
Crane	.00403
Water system	.00326
General surface	.00624
Power house	.00850
Total	$0.18161

*The briquette mill made 398 tons of briquettes at a labor cost of $0.945 per ton.

Converting at this plant cost $9.60 per ton of copper produced, or $0.0048 per lb. The converters were run on two shifts only.

Smeltery Brick-Laying Costs

The following interesting figures on the cost of laying brick were obtained from a large amount of construction work at a Salt Lake Valley smeltery:

Buildings. Based on bag-house construction:

Cost of brick per 1000	$5.75
Cost of lime per 1000 brick @ 18c. per bu	0.335
Cost of sand per 1000 brick @ 65c. per yd	0.193
Wages of masons per 1000 brick @ $5 per day	3.205
Wages of helpers per 1000 brick @ $1.75 and $2.25	1.530
Total cost per 1000 brick	$11.013

Average brick laid per 8-hr. day per mason, 1560.2
Average number of helpers per mason, 1.285

Foundations. Based on H. & H. pot foundations:

Cost of brick per 1000	$5.75
Cost of cement per 1000 brick @ 81.64c. per sack	6.625
Cost of sand per 1000 brick @ 65c. per yd	0.495
Wages of masons per 1000 brick @ $5 per day	5.164
Wages of helpers per 1000 brick @ $1.75 and $2.25	3.184
Total cost per 1000 brick	$21.218

Average brick laid per 8-hr. day per mason, 968.3
Average number helpers per mason, 1.877

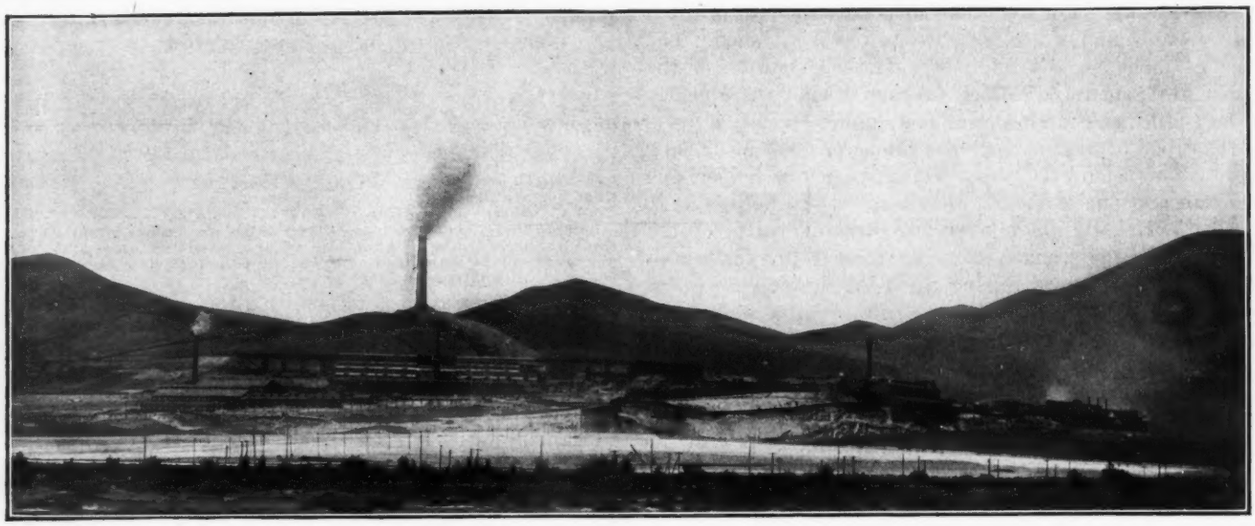
Flue Construction, over forms. Based on section of Fogh catenary flue 21-ft. base:

Cost of brick per 1000	$5.75
Cost of lime per 1000 brick @ 18c. per bu	0.35
Cost of sand per 1000 brick @ 65c. per yd	0.21
Wages of masons per 1000 @ $5 per day	7.353
Wages of helpers per 1000 @ $1.75 and $2.25	6.327
Total cost per 1000 brick	$19.99

The above includes bricklaying, tending and materials only. It does not cover freight, unloading, forms, etc.

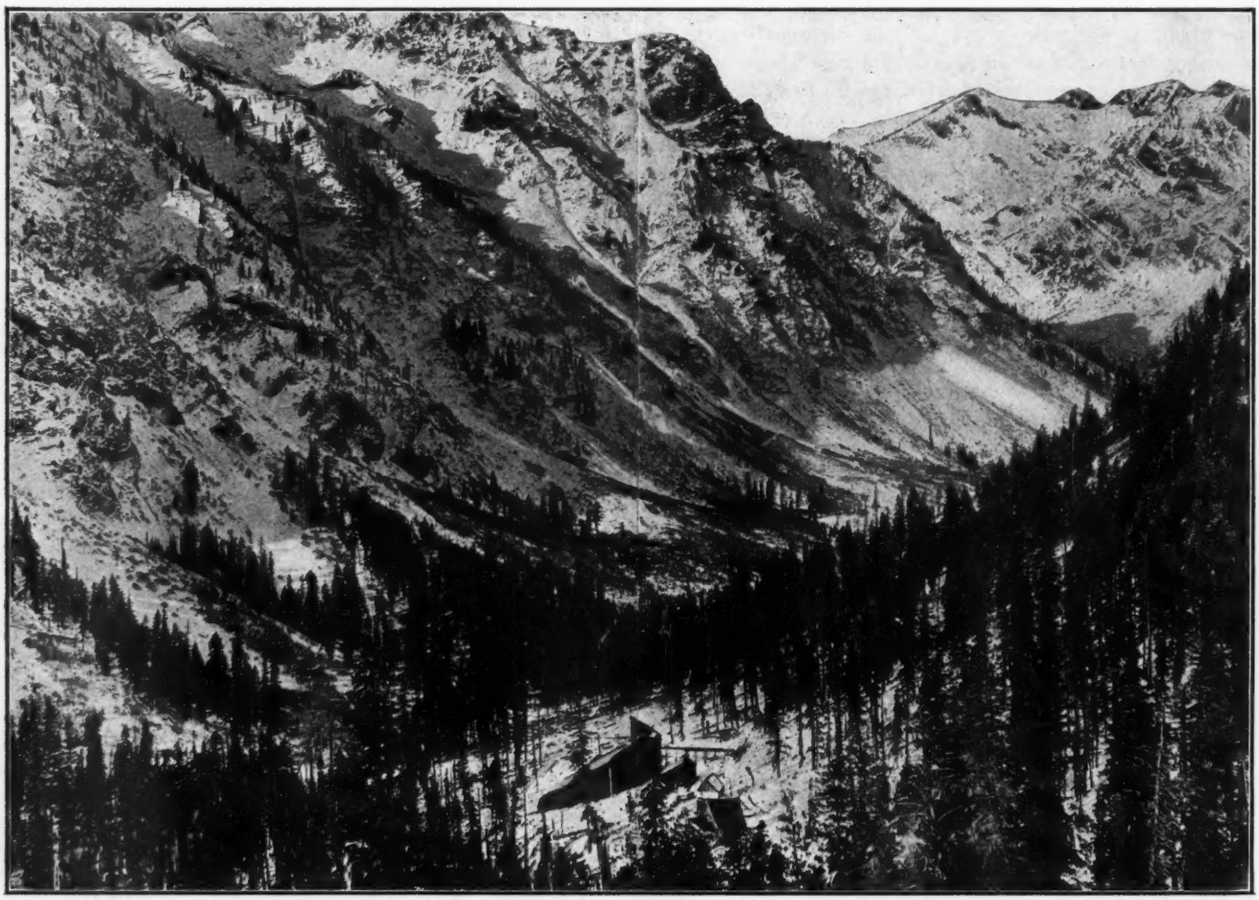
[1]"The British Columbia Copper Co.'s Smelter, Greenwood, B. C.," a paper to be presented at the San Francisco meeting of the American Institute of Mining Engineers, September, 1915.

Photographs from the Field

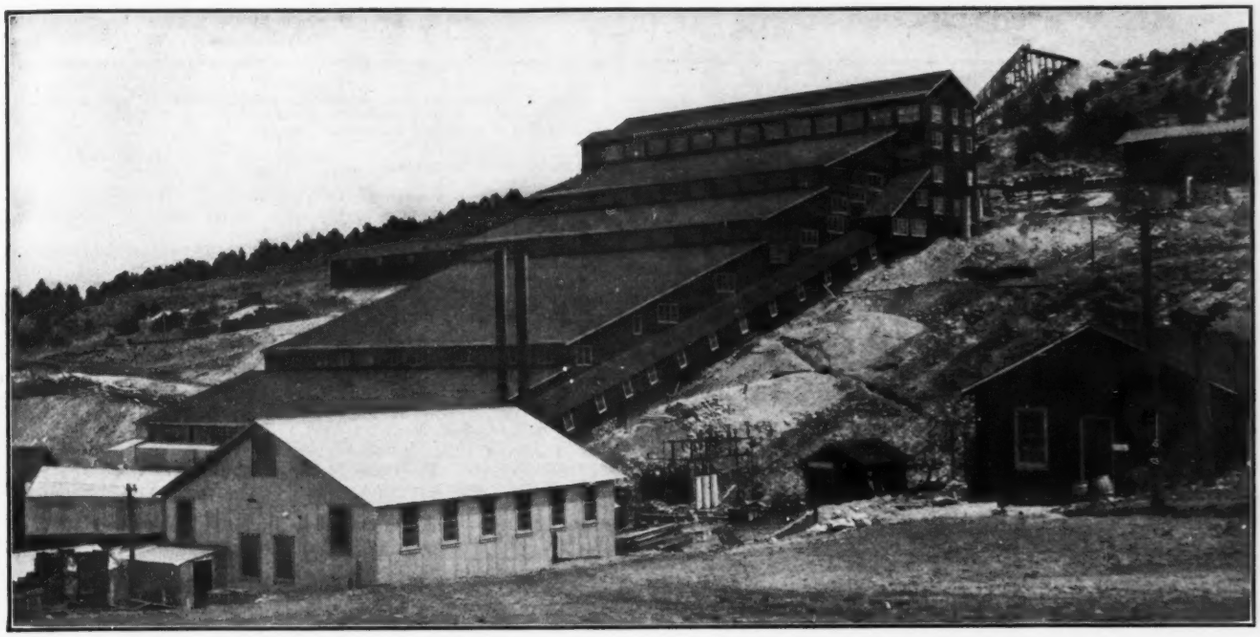


WASHOE REDUCTION WORKS OF ANACONDA COPPER MINING CO., ANACONDA, MONT.

This great works now exemplifies nearly every form of copper-ore reduction, having blast furnaces, reverberatories, converters, jig and table concentration, flotation and leaching



GENERAL VIEW OF BAKER MINES CO.'S TWENTY-STAMP MILL AND CYANIDE PLANT NEAR CORNUCOPIA, ORE.



THE FORTY-STAMP MILL OF THE AURORA CONSOLIDATED MINING CO. AT AURORA, NEV.

A new interest of the Goldfield Consolidated. The mill was built to treat 500 tons daily, and a good many changes were made in it when the ownership changed

LEAD SUBSTATION OF THE HOMESTAKE MINING CO.'S SPEARFISH HYDRO-ELECTRIC DEVELOPMENT

NEW PUBLICATIONS

PURCHASING. By C. S. Rindsfoos. 6x9, pp. 165; $2. McGraw-Hill Book Co., New York.

DIRECT-ACTING STEAM PUMPS. By Frank F. Nickel. 6x9, pp. 258, illus.; $3. McGraw-Hill Book Co., New York.

BULLETIN NO. 59, MISCELLANEOUS REPORTS. Pp. 252, illus. Geological Survey of Western Australia, Perth, W. A.

INDUSTRIAL ACCIDENT STATISTICS. By Frederick L. Hoffman. Pp. 210. U. S. Bureau of Labor Statistics, Washington, D. C.

COAL FIELDS AND COAL RESOURCES OF CANADA. By D. B. Dowling. Pp. 174, illus. Memoir 59, Geological Survey, Canada Dept. of Mines, Ottawa.

ENGINEERING ECONOMICS. First Principles. By John Charles Lounsbury Fish. 6x9, pp. 217, illus.; $2. McGraw-Hill Book Co., New York.

PRACTICAL OIL GEOLOGY. The Application of Geology to Oil-Field Problems. By Dorsey Hager. 5x7¼, pp. 149, illus.; $2. McGraw-Hill Book Co., New York.

THE GEOLOGY OF THE COUNTRY BETWEEN KALGOORLIE AND COOLGARDIE. By C. S. Honman. Pp. 80, illus. Bull. 56, Geological Survey of Western Australia, Perth, W. A.

A GEOLOGICAL RECONNAISSANCE OF A PORTION OF THE MURCHISON GOLDFIELD. By H. P. Woodward. Pp. 103, illus. Bull. 57, Geological Survey of Western Australia, Perth, W. A.

LES MINERAIS DE FER DE LA PROVINCE DE QUEBEC. Gisements et Utilisation. By P. E. Dulieux. 7x9¾, pp. 243, illus. Ministère de la Colonisation, des Mines et des Pecheries, Quebec.

THE SUPPOSED OIL-BEARING AREAS OF SOUTH AUSTRALIA. Investigations by Arthur Wade. 6¼x9½, pp. 54, illus.; paper. Bull. No. 4, Geological Survey of South Australia, Adelaide.

AN INTRODUCTION TO MINING SCIENCE. A Theoretical and Practical Textbook for Mining Students. By John B. Coppock and G. A. Lodge. 4½x6¾, pp. 230, illus. Longmans, Green & Co., New York.

MINERAL RESOURCES OF TENNESSEE, 1914. Twenty-Fourth Annual Report of the Mining Department. By George E. Sylvester. 5¾x8½, pp. 147. Mining Department of Tennessee, Nashville.

THE MINERAL PRODUCTION OF PENNSYLVANIA, 1911. 6x9, pp. 84. Report No. 8 E, Topographic and Geologic Survey Commission of Pennsylvania; Richard R. Hice, State Geologist, Beaver, Penn.

AN OUTLINE OF THE PHYSIOGRAPHICAL GEOLOGY (PHYSIOGRAPHY) OF WESTERN AUSTRALIA. By J. T. Jutson. Pp. 229, illus. Bull. 61, Geological Survey of Western Australia, Perth, W. A.

PRELIMINARY REPORT ON THE CLAY AND SHALE DEPOSITS OF THE PROVINCE OF QUEBEC. By J. Keele. Pp. 280, illus. Memoir 64, Canada Department of Mines, Geological Survey Branch, Ottawa.

SURFACE WATER SUPPLY OF THE YUKON-TANANA REGION, ALASKA, 1907 to 1912. C. E. Ellsworth and R. W. Davenport. Pp. 343, illus. Water-Supply Paper 342, U. S. Geological Survey, Washington.

GEOLOGY AND ORE DEPOSITS OF COPPER MOUNTAIN AND KASAAN PENINSULA, ALASKA. By Charles Will Wright. 9¼x11½, pp. 110, illus. Professional Paper 87, U. S. Geological Survey, Washington.

COAL FIELDS OF MANITOBA, SASKATCHEWAN, ALBERTA AND EASTERN BRITISH COLUMBIA. Revised Edition. By D. B. Dowling. Pp. 142, illus. Memoir 53, Geological Survey, Canada Dept. of Mines, Ottawa.

CONTRIBUTIONS TO ECONOMIC GEOLOGY. Short Papers and Preliminary Reports, 1913. Part II—Mineral Fuels. By Marius R. Campbell and David White. Pp. 187, illus. Bull. 581, U. S. Geological Survey, Washington, D. C.

THE NATIONAL DOMAIN IN CANADA AND ITS PROPER CONSERVATION. Presidential Address before the Royal Society of Canada, 1914. By Frank D. Adams. 6¾x9½, pp. 48, illus. Commission of Conservation, Ottawa, Canada.

THE A B C OF IRON AND STEEL. With a Directory of the Iron and Steel Works and Their Products of the United States and Canada. Edited by A. O. Bracket. 7½x10¾, pp. 338, illus.; $5. The Penton Publishing Co., Cleveland, Ohio.

ECONOMICS OF CONTRACTING. A Treatise for Contractors, Engineers, Manufacturers, Superintendents and Foremen Engaged in Engineering Contracting Work. Vol. II. By Daniel J. Hauer. 5¼x8½, pp. 334, illus. E. H. Baumgartner, Chicago, Ill.

THE AMERICAN FERTILIZER HAND BOOK. The Standard Reference Book and Directory of the Commercial Fertilizer Industry and Allied Trades. 7½x10½, pp. 402, illus. $1. Ware Bros. Co., Philadelphia, Penn.

The handbook continues to keep up its reputation as an invaluable guide to anybody in the fertilizer business. It consists, as usual, of a general review of the technical and financial conditions underlying the fertilizer trade, followed by a complete guide to buyers and sellers of all classes of material used in the fertilizer industry.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALKALI COMPOUNDS—Process of Obtaining Alkali Compounds Useful for Fertilizing. Thomas L. Willson and Maximilian Mattheus Haff, Ottawa, Ont., Canada, assignors, by direct and mesne assignments, to Southern Investment Co. of Canada, Ltd., Montreal, Canada. (U. S. No. 1,144,405; June 29, 1915.)

ALLOY-COATING PROCESS. Jay C. Beneker, Cincinnati, Ohio. (U. S. No. 1,144,524; June 29, 1915.)

CLASSIFYING—Process of and Apparatus for Sizing or Classifying Comminuted Materials. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. (U. S. No. 1,141,852; June 1, 1915.)

CONCENTRATOR—Pan-Motion Concentrator. Charles H. Muhleman, Western Springs, Ill., assignor of fifty-five-one-hundredths to Frank Low, St. Louis, Mo. (U. S. No. 1,141,972; June 8, 1915.)

CRUSHING—Ore Grinder. Edward F. McCool, Victor, Colo. (U. S. No. 1,144,305; June 22, 1915.)

ELECTROLYTIC APPARATUS. William E. Greenawalt, Denver, Colo. (U. S. No. 1,144,538; June 29, 1915.)

FILTER. William Poole Lass, Treadwell, Alaska. (U. S. No. 1,114,854; June 29, 1915.)

FLOTATION—Ore-Concentrating Apparatus. John M. Callow, Salt Lake City, Utah, assignor, by mesne assignments, to Metals Recovery Co. (U. S. No. 1,141,377; June 1, 1915.)

JIGGING APPARATUS. James W. Neill, Pasadena, Calif. (U. S. No. 1,144,494; June 29, 1915.)

LAMP—Miner's Acetylene-Gas Lamp. Justus A. Gustafson, Idaho Springs, Colo. (U. S. No. 1,142,699; June 8, 1915.)

MAGNETIC-SEPARATING APPARATUS. Edward H. Rothert, Leavenworth, Wash. (U. S. No. 1,144,383; June 29, 1915.)

METAL-COATING PROCESS. Jay C. Beneker, Cincinnati, Ohio. (U. S. No. 1,144,523; June 29, 1915.)

PULVERIZER. Frederick R. Cornwall, St. Louis, Mo., assignor to Williams Patent Crusher & Pulverizer Co., St. Louis, Mo. (U. S. No. 1,144,352; June 29, 1915.)

PURE IRON—Method of Producing Practically Pure Iron. Arthur P. Scott, Brackenridge, Penn., assignor to Allegheny Steel Co., Pittsburgh, Penn. (U. S. No. 1,144,256; June 22, 1915.)

SCREEN—Pulsating Screen. Edgar B. Symons, Milwaukee, Wis. (U. S. No. 1,141,153; June 1, 1915.)

SCREENING CONVEYOR. Thomas F. Webster, Sewickley, Penn., assignor to Link-Belt Co., Chicago, Ill. (U. S. No. 1,142,648; June 8, 1915.)

SEPARATOR—Magnetic Ore Separator. Sven Ragnar Salwén, Grangesberg, Sweden, assignor to American Grondal Co., New York, N. Y. (U. S. No. 1,141,833; June 1, 1915.)

STAMP MILL. Norman Taylor Harrington, Lansing, Mich. (U. S. No. 1,144,126; June 22, 1915.)

STEEL—Process for the Treatment of Steel. Federico Giolitti, Turin, Italy, assignor to Società Anonima Italiana Gio. Ansaldo & C., Genoa, Italy. (U. S. No. 1,144,034; June 22, 1915.)

SULPHIDE ORES—Process for Treating Complex Sulphide Ores. George E. Kingsley, Spokane, Wash. (U. S. No. 1,144,480; June 29, 1915.)

Gold Production in Australia

Official returns of gold production in the Commonwealth of Australia, in fine ounces, for the four months ended Apr. 30, Tasmania being estimated, were as follows:

	1914	1915
Western Australia	406,954	421,951
Victoria	133,425	104,601
Queensland	70,012	76,635
New South Wales	44,250	52,985
Tasmania	10,000	8,500
South Australia	2,500	2,000
Total	667,141	666,672
Total value	$13,789,804	$13,780,110

For the first time in several years the Australian production has held its own. In the period covered by the tabulation the decrease was only 469 oz., or $9694, being only 0.07%. The results in the different states, however, show considerable variation, the gains in Western Australia, Queensland and New South Wales being balanced by decreases in Victoria and in the other states. New Zealand has not reported monthly production this year, so that the official returns are confined to the Commonwealth.

Power Plant of Granby Mining & Smelting Co.

SYNOPSIS—An 800-kw. plant furnishing light, heat and power for the Granby Mining & Smelting Co.'s new zinc-smelting and acid works at Rose Lake, near East St. Louis, Ill.

About two years ago the Granby Mining & Smelting Co. built a large plant at Rose Lake, in East St. Louis, Ill., designed for the manufacture of spelter and acid. In the various processes of manufacture large quantities of steam will be required. Producer gas is to be used for smelting and calcining, and in the making of acid there will be large demand for water. The pumps and various other machines around the works are electrically driven, and current will be furnished from a central power plant. Direct and indirect heating for the various buildings, pottery rooms, etc., and the feed-water heater will take all of the exhaust steam, summer and winter. It is the intention to start manufacturing at an early date, and even now the power plant is running under a light load created by the preparations under way.

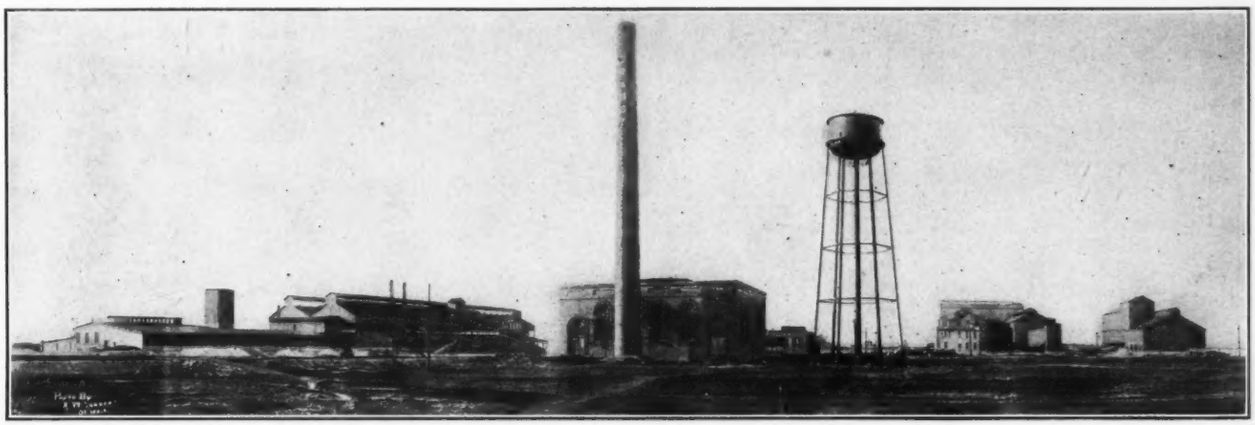


FIG. 1. GENERAL VIEW OF THE GRANBY PLANT AT ROSE LAKE, NEAR EAST ST. LOUIS, ILL.

A general view of the works is shown in Fig. 1. The power plant appears at the center of the picture. The interior plan dimensions are 89x98 ft. and the height from the floor to the roof trusses, 31 ft. The structure rests on massive concrete foundations designed to bear only two tons per square foot, owing to the presence of quicksand.

Liberal Boiler Installation

In the boiler room, shown in Fig. 2, the equipment consists of 1050 hp. in boilers divided into three 350-hp. units of the horizontal water-tube type. The settings are of the marine type, consisting of fire-brick, 3-in. asbestos blocks and a steel-plate covering. Steam at 150-lb. pressure is supplied to 800 kw. in generating capacity, an air compressor and the feed pumps, besides some required in the manufacturing processes. The uses for steam outside of generating electricity and the installation of a spare boiler account for the excess of boiler over generating capacity. The actual ratio is 1050 to 800, or 1.3 boiler horsepower per kilowatt.

Chain-grate stokers having an area of 70 sq.ft. serve the boilers. When compared to the 3500 sq.ft. of heating surface the ratio is standard at 50 to 1. The boilers are vertically baffled for three passes, and between the furnace and the first pass a restricted throat insures the thorough mixture of the gases so necessary for smokeless operation.

Details of Flue Design

The stack rises 185 ft. above the grates, the diameter is 8 ft. and the sectional area of the bore is a trifle more than 50 sq.ft. The ratio of stack to breeching area is thus 10 to 13, or 1 to 1.3. For every square foot of connected grate surface, there is 0.31 sq.ft. of breeching and 0.24 sq.ft. of stack. Per 1000 sq.ft. of boiler-heating surface the areas of breeching and stack are 6.2 and 4.7 sq.ft. respectively. A stack draft of 1.1 in. with a gas temperature of 500 deg. reduces to 0.8 in. at the breeching side of the damper on the boiler farthest from the stack. A drop of 45 to 50 per cent. through the damper and boiler setting gives a draft of approximately 0.4 in. over the fire.

Treating Boiler-Feed Water

Water for boiler feeding is taken from wells on the premises and is high in scale-forming matter. A hot-process system for treating it chemically before passing it along to the boilers was installed.

ANALYSIS OF WELL WATER

Chemical Impurities	Grains per U. S. Gal.
Suspended matter	1.00
Organic and volatile	2.12
Silica	1.75
Calcium carbonate	13.75
Magnesium carbonate	4.04
Magnesium sulphate	0.88
Sodium sulphate	0.35
Sodium chloride	0.29
Total solids	24.18

The apparatus in use at this plant is of the vertical type shown in Fig. 3. While the various parts going to make up the complete outfit are more or less standard, their arrangement and the combinations employed differ for each plant, so that a description of the present system

*Abstract of an article by Thomas Wilson in "Power," July 6, 1915.

may be of interest. The raw water from the service supply enters the heating section, shown at the top, through a balanced regulating valve operated by a float in the float box, which maintains a uniform level in the storage chambers above the filters. Within the heating chamber are trays for breaking the water up into a fine shower in order that the exhaust steam which enters through the separator attached to the heating chamber may heat the water to a point at or near boiling. The hot water then falls by gravity into the treating and sedimentation chamber, striking at the top a baffle which tends to distribute it uniformly and at the same time mix it with the reacting chemical which is fed into the raw water as it passes from the heating chamber to the treating and settling tank. This tank is made large enough to give the chemical time to act and the precipitate to settle to the bottom, where it can be drawn out through a sludge valve and discharged to any convenient point.

During this period the water passes down the outside and up the inside of the cone shown in the tank. At the top it is distributed between the two filter chambers set above the treating tank. In these are provided suitable supporting gratings carrying a wood-wool filter bed held in place by grids. The water from the treating tank may contain floating impurities that will not settle. These are caught by the filter and pure water passes up into the storage compartment above, where it is available for boiler purposes.

The filters are arranged in duplicate and so connected that one or both may be cut out of service for cleaning, at the same time leaving the heating section and the treating and sedimentation tank in service.

The amount of chemical to feed is determined by test, a simple equipment for the purpose having been provided. The proper proportion is then fed automatically into the system, which has a capacity to heat and treat 5420 gal. of water per hour.

When turning out the products for which the works was intended continuous service will be required from the power plant. The load night and day will run about the same, and reliability of service will be of the utmost importance, as discontinuance would entail a

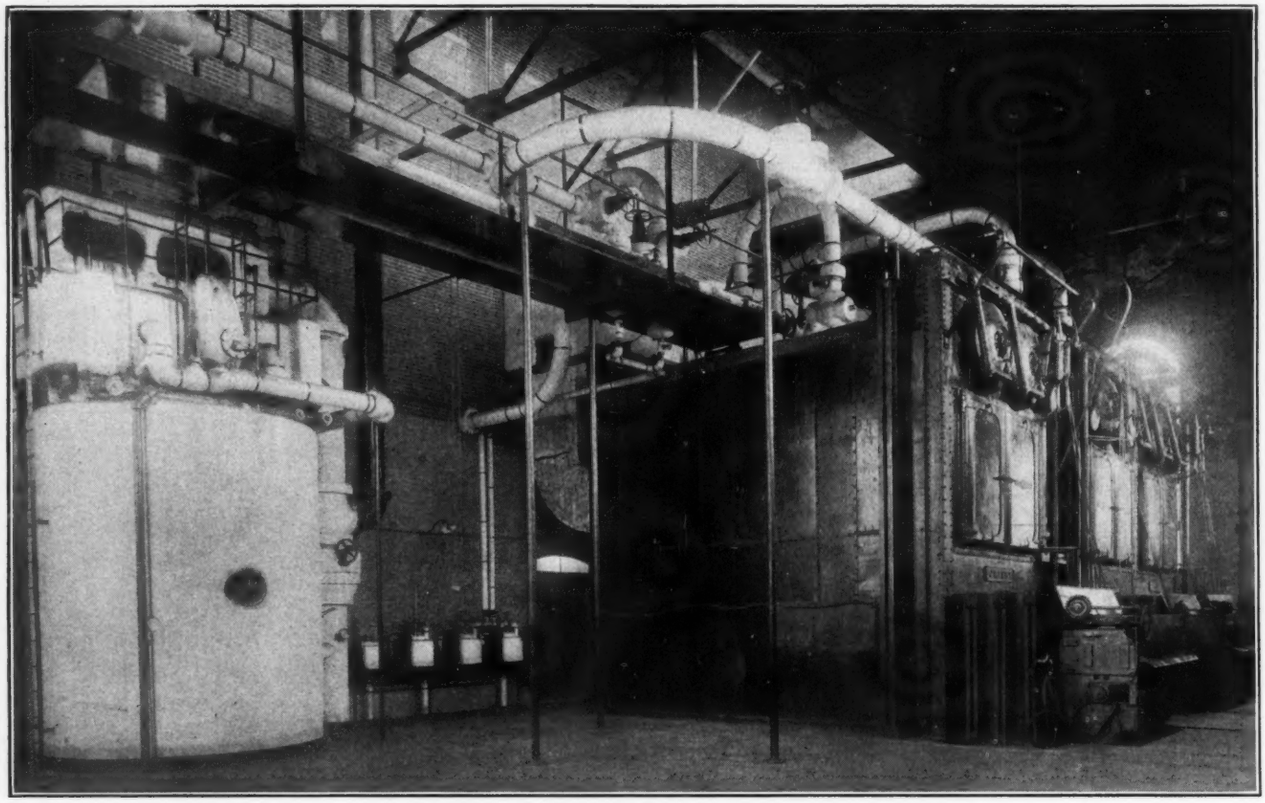


FIG. 2. THE BOILERS AND COMBINATION PURIFIER AND HEATER

PRINCIPAL EQUIPMENT UNITS OF GRANBY POWER PLANT

No.	Equipment	Kind	Size	Use	Operating Conditions	Maker
3	Boilers	Horizontal water-tube	350-hp.	Generate steam	150-lb. pressure, stokers, natural draft	Babcock & Wilcox Co.
3	Stokers	Chain grate	70-sq.ft.	Serve boilers		Babcock & Wilcox Co.
1	Stack	Tile and concrete	8x185-ft.	Serve boilers		Wiederholdt Construction Co.
1	Crane	Locomotive	10-ton	Unloading coal, etc.		Brown Hoisting Machinery Co.
1	Heater and purifier	Sorge-Cochrane	5420-gal. per hr.	Heat and purify feed water	Exhaust steam	Harrison Safety Boiler Works
2	Pumps	Duplex	10x6x10-in.	Pump boiler feed water	150-lb. steam	Epping-Carpenter Co.
1	Fire pump	Centrifugal	6-nozzle	Fire protection	Driven by 150-hp. Sprague motor	Alberger Pump & Condenser Co.
2	Engines	Simple Corliss	24x42-in.	Main units	150-lb. steam, 90 r.p.m.	Fulton Iron Works
2	Generators	D.-c. compound wound	400-kw.	Main units	110 volts, 90 r.p.m.	Sprague Electric Co.
1	Oiling system	Circulating and purifying		Serves main units and air compressor		S. F. Bowser & Co.
3	Oil pumps	Sight-feed	Two and six feed	Oil engine and compressor cylinders		Richardson-Phenix Co.
1	Air Compressor	Duplex	12, 19 and 12x14-in.	Compress air for tools, etc.	700 cu.ft. free air, 100 lb., 152 r.p.m.	Chicago Pneumatic Tool Co.
1	Crane	Traveling	10-ton	Serve engine room		Whiting Foundry Equipment Co.

large loss in the product under manufacture. For this reason duplicate generating units were installed, each capable of carrying the load while the other is held ready for service on short notice.

The engines are heavy slow-speed Corliss units, with cylinders 24x42 in., making 90 r.p.m., while the generators to which they are directly connected are really 600-kw. compound-wound direct-current machines, although rated at 400 kw., owing to the low speed. These massive units

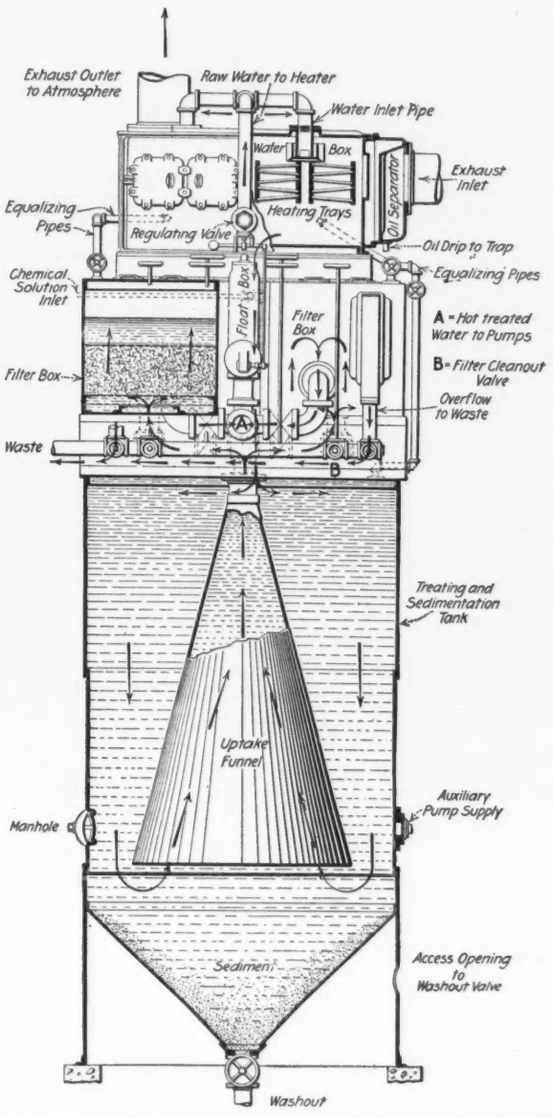


FIG. 3. SECTIONAL VIEW OF PURIFIER AND HEATER

are expected to care for the load with a minimum of upkeep and, above all, to give reliable service. The steam rate, although good for an engine of this type, is not of prime importance, as all of the exhaust steam will be utilized winter and summer.

Steam is supplied to each engine through an 8-in. pipe having a sectional area of 0.3474 sq.ft., or 1/8 sq.in. per kilowatt of rating. At 30 lb. per kw.-hr. the engine, at 50 per cent. overload, would require 18,000 lb. of steam, or 300 lb. per min. At 150 lb., and dividing by the area of the pipe, 0.3474 sq.in., gives for continuous flow a velocity of 2383 ft. per min. At quarter cutoff, however, steam would flow only one-fourth of the time, so that to supply the aforementioned amount of steam would require a velocity close to 9000 ft. per min. A receiver of course tends to equalize the flow. The longer the intervals between steam admissions, the larger this receiver should be. In the present case it was made 2¼ times the volume of the cylinder.

The exhaust piping is 10 in. in diameter, and for each kilowatt of rating it has an area of 0.197 sq.in. For 50 per cent. overload and continuous flow the velocity of the exhaust would be close to 12,000 ft. per min. At normal load this would reduce to 8000 ft.

Including building, chimney and all equipment, the total cost of the plant was $110,000, or $137.50 per kilowatt of rated output.

Granite Mountain Hoist*

The hoist now in course of installation at the Granite Mountain shaft of the North Butte Mining Co. is the largest electrically driven hoist of the Ilgner type on the two American continents. The hoist is designed to handle 7 tons of ore per trip. The ordinary hoisting speed will be 2700 ft. per min., but arrangements are made so that the speed can be increased to 3000 ft. per min. The equipment is designed to hoist from vertical depth down 4000 ft., and the cycles of operations have been chosen to give capacity from various levels approximately as follows:

300 tons per hour from the 2000-ft. level
250 tons per hour from the 3000-ft. level
200 tons per hour from the 4000-ft. level

The hoist has cylindrical drums 12 ft. in diameter and the rope to be used will be of 1⅝ in. plow steel.

The power required for hoisting will average about 1500 hp.; but to accelerate, the peak load will vary from 5500 to 4300 hp.

The direct-current hoist motor has a nominal continuous rating of 1850 hp., and has an intermittent rating of 2750 hp. It is guaranteed to handle 4500 hp. for a short time. The generator of the motor-generator set has a rating of 1500 kw. and can deliver 3750 kw. without trouble. The driving motor is 1400 hp.

The flywheel is 12 ft. in diameter, weighs 50 tons, and will have a speed of 400 to 500 r.p.m. The peripheral speed of the flywheel will be as high as 19,000 ft. per minute. In order to prevent any possibility of a flaw in this large wheel it is assembled out of sheets of rolled steel plate, each sheet being ½ in. in thickness. The total thickness of the combined plates is 21½ in. In designing this wheel the number of rivets was figured so that the plates are held together with sufficient pressure to hold any one plate by friction alone, eliminating any dependence on the shearing stress of the rivets. The entire wheel was carefully cut and finally polished and lacquered, so that it will present as smooth a surface to the air as possible and thus reduce friction. It was considered at one time that it might be advantageous to run the flywheel in a vacuum, but investigation proved that while such operation was feasible the application involved complications without sufficient increase in economy to compensate. The friction and windage losses of running the flywheel in the open air would amount to between 80 and 100 hp. This loss will be

*Abstract of a paper read before the Montana Society of Engineers, Butte, Mont., Apr. 10, 1915, by G. B. Rosenblatt, E. E.

reduced to about 50 hp. by enclosing the flywheel in a sheet-steel case carefully finished on the inside and fitting as closely as possible about the flywheel. Excluding the air from the cover and thereby running the wheel in a vacuum did not seem to reduce the loss by more than 12 or 15 hp., which would not justify the expense and complication of the necessary water-sealed glands, etc.

British Columbia Copper Co.

The report of the British Columbia Copper Co., Greenwood, B. C., for 1914 shows ore shipments from the company's mines tributary to the Greenwood smeltery amounting to 193,289 tons, of which 178,049 tons came from the Motherlode mine, 5332 tons from the Napoleon mine, 7920 tons from the Queen Victoria mine and 1988 tons from the Lone Star mine. No mention is made of the amount of metal produced or the average contents of the ore treated. The following statement of profit and loss is given:

Operating Disbursements	
Mining, smelting, freight, refining and selling charges, general office and administration expenses, maintenance and fixed charges and expenses incurred during the period the plant was closed down	$788,684.64
Custom ore purchased	162,434.84
Total	$951,119.48
Receipts	
Proceeds from metal shipments	$899,851.17
Miscellaneous earnings	11,503.76
Total	$911,354.93
Loss for year	39,764.55
	$951,119.48

A detailed analysis of the financial operations of this company is not possible from the condensed statements given by it, but it appears to us that, while a loss of only $39,765 is reported in the profit and loss statement just given, the company spent $540,330 more than it took in from operations. For example: At the end of 1913 it had a balance of quick assets of $122,406, and at the end of 1914 this balance had been spent, with an additional $417,925, this representing the excess of current liabilities over quick assets. This can be made clearer by the following figures as of Dec. 31, 1914:

Current Liabilities		
Accounts payable		$146,704
Amount advanced by Canada Copper Co.		340,000
Interest accrued to Canada Copper Co.		8,160
Loans and advances from banks		58,794
Reserve for sundry liabilities		500
Reserve for employer's liability		5,017
Total		$559,175
Current Assets		
Metals, smelter products, supplies, etc.	$112,801	
Prepaid insurance and taxes	4,693	
Sundry debtors	6,567	
Cash in banks	17,190	
Total		141,251
Current liabilities over current assets		$417,924
Balance of quick assets at Dec. 31, 1913		122,406
Total increase in current liabilities		$540,330
Loss reported in profit and loss statement		39,765
Other expenditures apparent		$500,565

This additional expenditure of $500,565 above those reported has probably been taken care of through the "Properties" account, but this account as given in the statement shows a decrease of $204,090.83 since the 1913 report was issued.

The report states that on account of the unsettled condition of the copper market during the last half of 1914 the company's smelter at Greenwood and operations at the mines from which the ore supply had been drawn were suspended in August. Development work was continued in a restricted way at the Copper Mountain property. It is stated that 6,200,000 tons of reasonably assured and probable ore of an average grade of 1.82% copper has been developed. There is also 750,000 tons of 1.54% ore developed. When this work has further progressed it is intended to arrange for improvements and equipment to treat these ores. The sum of $183,203 was spent in development work during the year. There are options outstanding on 11 claims for $188,000, upon which payments of $52,545 have been made. The amount shown in the financial statements of $3,400,000 for properties is the result of a preliminary valuation by the company's engineers of all its properties.

Extralateral Mining Rights

By A. L. H. Street*

In affirming judgment for defendant in a suit to recover damages for trespass upon a mining claim and wrongful removal of ore, the Supreme Court of Colorado lately decided in favor of the defendant in the case of Esselstyn vs. United States Gold Corporation (149 *Pacific Reporter,* 93). The defendant owned a senior lode mining claim on which a broad vein had its apex, but passed outside the side lines extended and under plaintiff's junior claim, where it was intersected by three veins, each of which had its apex on plaintiff's claim. It was decided that the defendant was entitled to the ore within the intersection by virtue of the provisions of Section 2336 of the United States Revised Statutes.

Anaconda-Amalgamated Distribution

The Amalgamated Copper Co. has issued notice that the statutory proceedings for the dissolution of the company have been completed, and the distribution of the assets can now be made on the basis stated in the company's circular of May 6. Each holder of one share of Amalgamated stock will receive one share of the new issue of the Anaconda stock, par value $50, and a cash distribution of $3. The transfer books of the Amalgamated Copper Co. will be finally closed on July 31 at noon, and the distribution will begin on Aug. 30 at noon on presentation of the certificates of stock at the company's office. Checks and Anaconda stock will be issued only to stockholders of record of July 31.

Costa Rica Production of Precious Metals decreased last year, according to a recent report from the Bureau of Foreign and Domestic Commerce, which says: "The following are the values of gold and silver mined and exported during each of the past five years: 1910, $811,186; 1911, $1,190,406; 1912, $817,565; 1913, $1,021,473; 1914, $888,599. The decrease during 1914 is partly explained by the fact that the Abangarez goldfield, the largest producer in former years, was shut down during nine months of 1914. In the early part of 1915 the Abangarez mines were placed under new management, and at present work is under way toward reopening these properties. The mines owned and operated by the Panama & Costa Rica Mining Co., the Aguacate Mines of Costa Rica, and the Montezuma Mines of Costa Rica were worked throughout the year with generally satisfactory results. These mines are mostly owned by American capital, and the entire product eventually reaches the United States."

*Attorney, St. Paul, Minn.

Editorials

Doctor Holmes

The death of Doctor Holmes on July 12 was not unexpected, inasmuch as he had been in poor health for a good many months and absent from his office in Washington. The latter is not to say that he had relinguished his duties. On the contrary, while he was at Fort Bayard, N. M., he kept a secretary with him and insisted upon directing many of the affairs of his bureau in spite of the solicitation of his friends who knew that he was overtaxing his strength and were apprehensive of what would be the outcome. This persistence on the part of Doctor Holmes was characteristic of him, however, and a fittting epitaph for him would be, "He lived with his work."

Doctor Holmes first attracted general attention by his services as chief of the Department of Mining and Metallurgy at the St. Louis Exposition. He filled that difficult position with an intelligence and suavity that charmed everybody; and he evinced a diplomacy that gave no ground for complaint to any jealous exhibitor. His particular interest, however, was in certain experimental technological work that was conducted at the Exposition, and upon the closing of the latter it was but natural that this work should be conducted by a technologic branch created in the Geological Survey and that Doctor Holmes should continue to direct it. When the Bureau of Mines was established upon the basis of the Technologic Branch it was equally natural that Doctor Holmes should become its first director.

The Bureau of Mines became his child. He practically created it, organized it and laid out its course. There is scarcely anything in it whereof the inception is not owed to him. He was ambitious for it and sometimes was criticized for the vaulting character of his ambition, although everybody recognized that there was never in his mind any thought of personal aggrandizement, but only thoughts for the prestige and public usefulness of his institution. For that institution he worked during every one of the 24 hours of the day except the few hours of sleep, traveling thousands of miles annually—enduring the hardships of railway tedium, poor food and miserable hotels—and holding intercourse with thousands of persons. The ability to get on well with people was one of his happy faculties, as also was his art of surrounding himself with able and loyal assistants.

He was never willing, however, to relieve himself of arduous duties by delegating them to his assistants. Their purpose, in his mind, was solely to enable his bureau to do more work, and he devoted himself indefatigably to finding it for them to do. With all of this he made the Bureau of Mines a great thing in remarkably few years, but in doing it he killed himself, leaving the mining and metallurgical industries of his country his eternal debtors. His special interest was the promotion of safety in mining. With keen perception he singled out the correction of the disgracefully high mortality in American mining as being the first big work that the Bureau ought to do.

Transition in Metallurgy

The present era is one of frequent and rapid changes in metallurgical practice. During the last three years—and this very likely will be repeated during the next three—processes have risen into prominence, enjoyed a superlative day and then begun to wane. If the prognostications of some of the most highly skilled of our metallurgists are to be credited, we shall soon begin to characterize the process of acid leaching of copper as the brightest and most transient of all the metallurgical stars. Because of practical necessity for a treatment system to fill in the bare places left by the better-known ones, leaching seemed to spring full-grown into being. Colossal plants have been built for its practice, but before even the completion of the greater plants a sturdy opponent has appeared to seriously question the economy of their working. Advocates of flotation maintain that there is no place for leaching in the copper field and that all that can be hoped for through leaching can be obtained with less cost, both of operation and of installation, through some flotation system. Whatever may be the truth of the matter, the fact remains that hardly any system of metallurgy—at least so far as wet treatments are concerned—is so firmly founded as to be able to disregard the advances of some other system. In Utah a highly economical system of roasting has made the return of chlorination possible. Even the cyanide process is challenged by flotation, and while not likely to be entirely supplanted, part of its field may easily be preëmpted. As to other processes, they are so many and so varied that it would be difficult to enumerate them, while the various combinations of two or more of them are almost without number.

Value of Money and Commodities

When the war began, prophecies about its effect upon trade and finance abounded. Some of these were good, but many of them—perhaps the major part of them—have failed of verification just as much as the military prophecies. Consequently it has become the tendency to express forecasts of the future now with a spirit of caution and humility. Yet in the forecasts of last fall there were many things foreseen fairly well. When England was demanding gold from us and sterling exchange was above $5, it was distinctly foretold that the gold would soon come back and that exchange would fall far below par. The enormous cost of the war, the tension in Europe's credit, and the gradual passage of some of the countries of Europe to a paper basis were prophesied and have come, or are coming, to pass. The purchasing of war material in this country is no surprise to us, although the magnitude of the transactions is indeed astonishing. Certainly the fulfillment of prophecies is such that the prophet of today should not be entirely without honor.

We may therefore listen with patience to the pronouncement that the warring nations of Europe, England perhaps excepted, are gradually going upon a paper basis and that a natural consequence thereof will be inflation; that the United States is being flooded with gold and through its new banking system will also possess the means for inflation. Assuming such to happen—and there is considerable evidence pointing toward it—the corollary is a decrease in the purchasing power of money and an increase in commodity prices. The index numbers show that some increase has already been experienced.

If this forecast indicates correctly the general trend of economics the lesson is that bonds will depreciate in value while stocks, especially the stocks of companies producing the staple commodities, will increase in value. In other words, it will be better for investors to own property than to lend upon it.

We have been startled by the extent of the rise in the prices of some of the metals—staple commodities of basic nature—especially spelter and copper; but while they will probably recede from their highest points, it may be that the world is entering upon a period during which the price for them, as well as the prices for all staple commodities, will prevail at a higher level than what we used to consider the normal previous to the war.

⁂

Lacing Method of Making Primers

Two methods of securing the cap and fuse in the primer stick of dynamite to obviate the liability of its pulling out were given in the *Journal* of June 19 and July 3. The first of these—lacing the fuse through the stick of dynamite—is so common that it may well be said to be the universal way of making primers. Almost everyone recognizes the danger of the fuse igniting the dynamite, with the resulting burned hole and all its disadvantages, and the likelihood of the powder train in the fuse being broken by the sharp bends where the fuse enters and leaves the stick of dynamite. When the latter is pushed into the hole with the tamping stick, the fuse on both sides of the dynamite is liable to be ground off by contact with the sides of the drill hole, breaking the powder train and causing misfires. However, the handicaps of this course, though commonly recognized, are often considered to be less than the disadvantages of some other method of inserting the cap. A practical miner sends the following brief in favor of lacing:

> About lacing the fuse in the powder, we shoot 30 and 40 holes in the winze and lace them all and never have more than 2 or 3 missed holes. They won't say it is the cap or fuse. I will bet none of them guys who say it makes the powder burn in the holes saw it do it. What do you think?

The writer of this letter makes the strongest argument possible against the method which he is advocating. If he has 2 or 3 burned holes out of a round of 30 or 40, he is losing 8 to 10% of his holes, and when the cost of shooting them over is considered, together with the additional time wasted in waiting for the powder smoke to dissipate, the blasting costs are going to be increased from 12 to 15%. In addition to this, it is obviously impossible to predict which holes are going to misfire, and if these misfires happen to be the cut holes, then the entire round is lost and will have to be shot again. The blasting expense is not only doubled, but the results from a round that is shot over are never so good as would have been obtained had the first shooting not misfired.

Lacing fuse through sticks of dynamite though common, easy and convenient, is bad practice. If other means suggested seem to have disadvantages out of proportion to the benefits they afford, some entirely new way should be sought rather than to stick to the old lacing method with its known faults and dangers. It was for this very purpose that the device described and installed in the later *Journal* article was devised. It is used advantageously in South Africa and could well be adopted in this country. It is simple, cheap and effective.

⁂

Charles Hayden, recently returned from an inspection trip through the West, stated that the policy of the copper companies in which he is an important factor would be to distribute in quarterly dividends such profits as the respective companies were earning if copper were figured at 13c. per lb. At the end of the year the surplus would be paid out as an extra dividend, always retaining in the treasury sufficient cash and cash assets to carry on the business of the company in a safe and independent way. This is certainly a very conservative policy. Adherence to it, or something like it, has enabled Utah to escape the necessity of ever having to reduce its dividend. Even during the disastrous second half of 1914 that company maintained its dividend while most of the others had either to cut or to suspend.

⁂

A well-known roller of sheet zinc wrote to the *Journal* with reference to an illustration used in an editorial in the issue of June 19 that a zinc stove-board blank would ordinarily be only about 36x42 in. of No. 9 sheet (0.018 in.) and not the larger size and heavier sheet that we stated. We plead guilty to an inadvertence. The instance that we had in mind was an occurrence, but in order to make the illustration more homely the case of a stove-board blank was substituted in rewriting the manuscript and the incongruity of what followed was overlooked. Nevertheless, the ratios remained the same of course; and so does the point that the high price for sheet zinc is seriously curtailing the consumption of it for many ordinary purposes.

⁂

One European and neutral country has benefited by the war. The last report of the Bank of Norway shows the highest gold reserve ever reported by that institution, and the people are said to be unusually prosperous. In part this prosperity has been due to the high rates for ocean freights. Norway is a large vessel owner, and its ships are engaged in commerce all over the world. The boom in the freight business has been helped by an unusually good fishing season, adding to the prosperity of the kingdom.

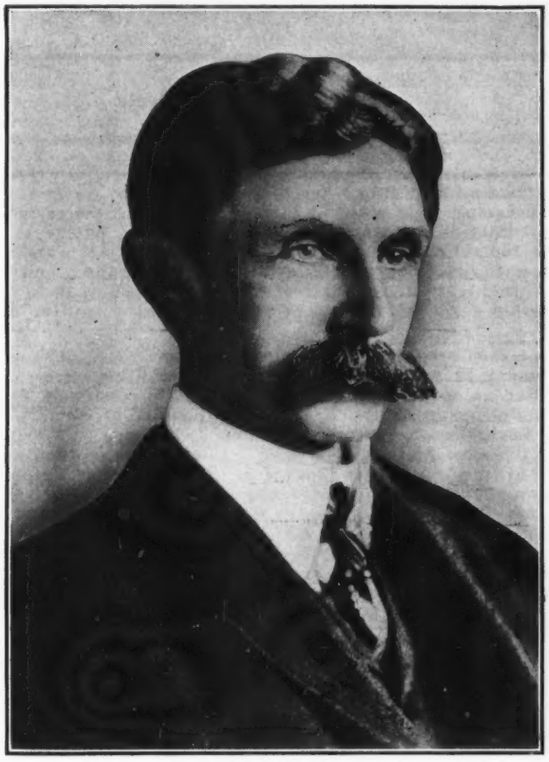
⁂

It is understood that the new 2000-ton leaching plant of the Anaconda Copper Mining Co. is coming fully up to expectation. Since it was put into operation an average upward of 1900 tons of ore per day has been put through it and the tailings have averaged but 0.09% copper. The art of metallurgy appears to be making such progress that mammoth new plants are now put into operation without experiencing any of the infantile troubles that used to be expected.

Joseph Austin Holmes

Dr. Joseph Austin Holmes, chief of the Bureau of Mines for just five years past, or ever since it was organized under its present form, died at Denver, Colo., July 12, aged 55 years. His death was not unexpected by his intimate friends, but it will be the cause of widespread regret among the mining fraternity of all ranks, which he had served well for a number of years, since his work began long before the Bureau of Mines was constituted as a separate body.

Doctor Holmes was born in Laurens, S. C., in 1859. He was educated at local schools and at Chapel Hill, N. C., and graduated from Cornell University at Ithaca, N. Y., in 1880, taking the geological and scientific course. In the following year he was appointed professor



JOSEPH AUSTIN HOLMES

of geology and natural history at the University of North Carolina and remained there for 10 years. In fact, his connection with the university lasted very much longer, for he continued to lecture there for a number of years after he had given up the active duties of his professorship. In 1891 he was appointed state geologist of North Carolina and for three years devoted his time to the reorganization and improvement of the department. He had taken an active part in the geological exhibit at the Buffalo Exposition in 1901 and this pointed to his selection as head of the Department of Mines and Metallurgy at the St. Louis Exposition in 1904. While there, he originated the idea of a plant for testing fuels and structural materials, in the establishment of which he was ably aided by Messrs. Parker and Campbell. He continued in charge of the Geological Survey laboratories for three years, at first in St. Louis, then in Pittsburgh and finally in Washington. In 1907 he was made chief of the technologic branch of the Geological Survey and held tnat position until the Bureau of Mines was established by act of Congress on July 1, 1910. There were several candidates for the position of head of that bureau, but when Doctor Holmes was finally appointed, the universal approbation which greeted him in his new position was sufficient evidence of the wisdom of his selection.

Since his appointment, his activities had been incessant, all branches of the work receiving his constant attention and supervision, while at the same time he gave as much as possible of his time to outside societies and to committee work which would aid in the objects of the bureau. Thus he served on the International Mining Commission as representative of the United States to aid in the adoption of safety devices, both in this country and abroad. He was a member of the United States Conservation Commission and of the Mining Investigation Commission of the State of Illinois. The work of accident prevention and rescue, specially interested him, and it was largely owing to his influence that the plan of equipping a number of railroad cars as movable safety stations was adopted. He also used all his influence in favor of the measure for the admission into the United States free of duty of rescue and safety apparatus made abroad, in which he was finally successful. He had been suffering for some time from the disease of which he died, but it was not until the last few months that he allowed this to interfere with his varied activities.

Besides his official position, Doctor Holmes was a fellow of the Geological Society of America, member of the American Institute of Mining Engineers, of the Mining & Metallurgical Society of America, of the American Society of Mechanical Engineers, the American Society for Testing Materials, the Washington Academy of Sciences, the St. Louis Academy of Sciences and many minor scientific associations. He was a great traveler and was known personally to mining men in almost every part of the country. With many of these he first came in contact at the St. Louis Exposition in 1904, where the excellence and thoroughness of his work and his talents as an organizer were first generally recognized. From that time on, it may be said that he took the prominent position to which his ability and devotion to his work entitled him. Naturally, he was an able teacher, and his promotion was a serious loss to the University of North Carolina, which he had served faithfully for more than ten years and to which he continued to be much attached, although he was absorbed in his wider field of action.

Three years ago a friendly critic in *Coal Age* said of him—and his words have been amply justified since:

> Only his force of character, united to dexterity of action and ease of manner, could have secured from Congress the recognition, financial and otherwise, which has so far been accorded the Bureau of Mines. Many men have weight; Doctor Holmes has momentum. Lots of people know what to do; he knows how to do it. His diplomacy is the sort that enables a man, without deception or hypocrisy, to be seemingly the same to all men, yet varying with each, according to his peculiarity and according to the mind of the man at the time.

Doctor Holmes was married in 1887 to Miss Jeanie L. Sprunt, of Wilmington, N. C. He leaves two sons and two daughters.

PERSONALS

Sydney H. Ball is in Tennessee for 10 days on professional business.

H. W. Hardinge has returned to New York from an extended trip through the West.

A. M. Plumb of the American Zinc Ore Separating Co., has been in the Silverton district, Colo., on business.

J. B. Tyrrell, of Toronto, Ont., will shortly go to examine some silver properties in the Port Arthur district of Ontario.

G. A. Loomis, representing New York parties, is making an inspection of some of the Big and Little Cottonwood properties in Utah.

R. C. Coffey, formerly superintendent of the Uwarra mill in North Carolina has returned to the Cobalt-Porcupine country in Ontario.

Hennen Jennings has gone to Ruby, Mont., whence he will proceed to San Francisco, where he will spend the remainder of the summer.

Fred H. Nye, of Denver, has been made mine superintendent for the Boulder Tungsten Production Co. with office at Boulder, Colorado.

F. W. Sherman has resigned from his position as superintendent of the Daly West mine, and will leave Park City, Utah, where he has lived for the past 15 years.

Franz Juretzka, of Breslau, a well-known German zinc metallurgist and contributor to the "Journal," is now serving as a volunteer in the Ersatz battalion of Grenadier regiment No. 11.

Walter Harvey Weed is at Butte, Mont., on mining examination work and expects to make a trip to Newfoundland on his return to examine some large copper deposits in that region.

John A. Baker, formerly construction engineer for the Tough Oakes mill in Ontario, has accepted the position of milling superintendent for Moose Mountain, Ltd., at Selwood, Ontario.

Prof. C. L. Crandall, dean emeritus of the College of Engineering of Cornell University was the guest of honor at a banquet given July 6 at the University Club by Cornell alumni of Salt Lake City.

H. M. Montgomery, chairman of the Chicago section of the American Society of Mechanical Engineers, has been elected vice-president and director of the Powdered Coal Engineering & Equipment Co., Chicago.

N. L. Heinz, who designed the Langeloth plant of the American Zinc & Chemical Co., completed the first unit of it and made provisions for the remainder, is now engaged with the American Steel & Wire Co. in the designing and building of the new zinc and acid plant at Donora, Pennsylvania.

The gold medal awarded by the British Institution of Mining and Metallurgy to Dr. Willett G. Miller, provincial geologist of Ontario, was formally presented to him on July 7 by Hon. W. J. Hanna, acting premier of the province. This is the first time that the medal has been given to a Canadian.

Dr. Bailey Willis has been appointed professor of geology at Leland Stanford University in California, taking the place of Dr. J. C. Branner, who is now president. Dr. Willis was for a number of years on the U. S. Geological Survey; more recently he has been consulting geologist and has conducted explorations in China and for the Government of Argentina.

Dr. Rukard Hurd, secretary of the Minnesota State Tax Commission, will resign July 15 to devote his time to iron-ore assessments and kindred subjects. Doctor Hurd is an authority on valuation of iron ores and has guided the Minnesota Tax Commission in the adoption of taxation methods on unmined tonnages on the Mesabi, Vermilion and Cuyuna ranges. He will be succeeded by Henry A. S. Ives, a St. Paul newspaper man.

OBITUARY

William C. Squier died at Rahway, N. J., July 7, aged 70 years. He was concerned with his father in the establishment of the New Jersey Zinc Works, and was connected with them for many years, retiring 15 years ago.

P. J. Tallon, assistant secretary of the Silver King Coalition Mining Co. died at Park City, Utah, July 4, aged 40 years. He was born in New York and had lived in Utah since 1884. He was elected mayor of Park City last year.

William H. Gorman died at Bedford Springs, Penn., July 7, after a stroke of paralysis. He lived at Oak Forest Park, near Catonsville, Md., and was President of the Gorman Coal & Coke Co., the Cumberland Coal Co., and the Piedmont Mining Co. He was also a director of several banks.

T. J. Vandergrift died at Columbus, Ohio, July 3, aged 52 years. He was born in Pittsburgh, and his first work was in transporting oil down the Allegheny River. Later he became an oil operator and was prominent for many years in Pennsylvania, West Virginia, Ohio, in the West and in Mexico. He was the first to introduce the use of natural gas in Pittsburgh. He was one of the first to study the relation of petroleum to geology and also one of the first to follow out the theory of anticlinals and synclinals. He was foremost in discovering oil territory in Pennsylvania, New York, Ohio and West Virginia and took first rank as a prospector, or "wildcatter." For many years he was one of the most progressive and successful oil producers and his judgment was considered excellent by many of the most prominent operators. In fact, wherever it was known that "T. J." had started a well or was about to start a well, leasing in the vicinity at once became active.

SOCIETIES

American Mining Congress—Directors of the Utah chapter at a meeting held July 7 decided on a campaign for increased membership. It is planned to give all persons interested an opportunity to join in the chapter's organized efforts to develop and aid the mining industry of the state. Accurate local mining information will be collected and compiled, and will be available to those interested. A. G. MacKenzie of Salt Lake has been selected as secretary by the executive committee.

Colorado School of Mines—On July 8, the board of trustees appointed as president William Battle Phillips, director of the Bureau of Economic Geology in the University of Texas. Prof. Phillips graduated from the University of North Carolina in 1877, subsequently spending two years at Freiberg and obtaining a mining degree. He is a member of the American Institute of Mining Engineers. He has been connected with numerous mining enterprises in the Southwest and is endorsed by officials of the U. S. Geological Survey and the U. S. Bureau of Mines. His duties will commence Aug. 1. Prof. William G. Haldane, who has been acting president of the school for the past two years will resume duties on the faculty as associate professor of metallurgy.

TRADE CATALOGS

The National Tube Co. has issued a bulletin, No. 20, which carries an index to all the bulletins preceding it.

Locomobile Co. of America, Bridgeport, Conn. Catalog. Locomobile Worm Drive Motor Trucks. 43 pp., illus., 8½x11 inches.

Sanford-Day Iron Works, Knoxville, Tenn. Sectional Catalog No. 25. Mine Wheels, Mine Trucks, Cars, etc. Illus., 8½x 11½ inches.

The Esterline Co., Indianapolis, Ind. Catalog No. 364. Golden Glow Incandescent Headlights for Mine, Railway and Industrial Service. 32 pp., illus., 6x9 inches.

The H. K. Porter Co. has just issued the eleventh edition of its catalog, which is really a textbook on locomotives. Because of the expense of preparation this book cannot be sent out indiscriminately, but will be mailed to those not in the market for locomotives on receipt of $1, a low price considering the excellence of the book.

Multi-Metal Separating Screen Co., 68 East 131st St., New York. Catalog: Pulmosan Respirator. 8 pp., illus., 9x6 inches. This company has for years been manufacturing fine wire screens, as fine as 100,000 meshes per square inch, hence they could logically undertake the problem of devising a respirator to fill the needs brought to the company's attention by Dr. Otto Glogan, oto-laryngologist, delegated by New York State to make research along these lines. The Pulmosan Respirator devised consists of a combination of screening materials supplementing each other to form a perfect air filter which keeps out the finest dust particles.

Editorial Correspondence

SAN FRANCISCO—July 7

Natomas Consolidated Deeds conveying properties to Natomas Company of California were executed June 15. On June 17 delivery of Natomas securities in exchange for interim certificates representing first mortgage bonds of Natomas Consolidated was begun by the Mercantile Trust Co. at San Francisco. Natomas Co. will begin operations with the following capital obligations: Five-year 6% notes (estimated) $2,500,000; general and refunding mortgage 6% bonds $8,398,200; preferred stock (68,363 shares) $6,836,300; common stock (92,405 shares) $9,248,500. Total $26,983,000. Organization of the Natomas Co. authorized $3,000,000 of five-year notes but improvement in operating conditions diminished the amount by $500,000. None of the common stock will be in the hands of the public. This issue will be held by a British holding corporation which will issue its ordinary shares to former holders of second mortgage bonds and common stock in the Natomas Consolidated. The old second mortgage bondholders will receive approximately 25% or 50 shares for each $1000 bond. The old common stock holders will receive one share for $100 share formerly held in Natomas Consolidated. There will be some ordinary shares to cover a bonus arrangement. The trust company will be unable to distribute securities to holders of second interim certificates for several weeks owing to the fact that the British end of the transaction is not entirely completed. Also the capital liabilities of the holding company, for the same reason, cannot be given out for two or three weeks.

Revision of Tentative Mine Safety Rules was begun at a public hearing provided by the California Industrial Accident Commission. The hearing was attended by members of the California Metal Producers Association and operators and managers of a number of the large productive deep mines. Changes agreed upon at the meeting and suggestions or tentative changes from the text will be prepared by the committee who formulated the initial rules and the corrected form will be submitted to another public hearing. The most important change insisted upon at the meetings was a revision of Sec. 41, providing for the elimination of dust. The section was amended so that "inhalation of dust" will be substituted for "escape of dust." This permits the use of respirators instead of requiring the use of spray and water drills. The use of "T" rails in place of strap iron was also objected to; and some other changes asked. Until the rules are satisfactory to a majority of the attendants upon these public hearings they will not be adopted by the commission. There is no danger of the present mining engineer of the commission, or the commission itself, nor the committee of mine superintendents and mine workers who formulated the rules endeavoring to accomplish anything to the detriment of mine operation or to the workmen. The rules in some respects appear to be rather drastic and it is natural that some of the mine operators object to such rules as will require considerable expenditure of money to insure the safety of men, when they believe that less drastic measures may be adopted with equal success. But there is no reason for anyone to grow restive or belligerent respecting the outcome.

SMARTSVILLE, CALIF.—July 3

Renewed Activity in Smartsville, Yuba County, is attracting attention. Johnson, Hite, and Kibbe have leased from the Excelsior Water Co. what is known as the Lone Tree Hill quartz ground and are sinking on a 20-in. vein of gold bearing quartz. They have some good rock in sight. This ground was worked a little about 35 years ago. Some of the rock was very rich and some was hauled to Grass Valley and milled returning about $35 per ton. It is a free milling ore. A. McRae and A. Spencer have reached bed rock and are drifting for pay on their lease from the Excelsior Water Co. at Smartsville. There are some good streaks in these old channels. The gravel is hard and has to be blasted and then ground in some kind of mill to get the gold which is mostly small and flakey and rather hard to save as "quick" does not take hold readily.

BUTTE—July 7

Workmens' Compensation—When the state compensation law went into effect July 1, it placed 32,000 employees in Montana under the protection of the provisions of the law. These 32,000 workers will be paid for accidents that may befall them while in the line of their employment; about 25,000 of the men are insured under plan No. 1 in which the companies carry their own insurance. The liability companies have taken the risk for 5000 employees and 2000 are insured under plan No. 3 directly by the state, the money coming from employers. The 9 Anaconda Copper Mining companies, the 10 W. A. Clark companies and other big concerns carry their own insurance, having produced satisfactory proof of their solvency. The first employee to receive the benefits of the new law is Samuel Shepardson, of Butte who on July 1 had his leg sprained while in the employ of the Jones Transfer company. During first two weeks insurance company will pay his doctor and medicine bills, after that he will receive $10 per week as long as he is incapacitated. Had he been killed his family would have received $4000.

DENVER—July 8

Thirty Tons of Titanium Ore have been shipped from the northern New York mining field to the Colorado School of Mines, Golden, to be tested in the metallurgical plant by several flotation, electrostatic and magnetic separation processes.

Highgrading in the Cripple Creek District continues under rigid ban. In the district court last week, Judge Sheafor sentenced Thomas Moynahan, an assayer, to a term of from 2 to 4 years in the penitentiary. Another assayer is awaiting similar trial.

Standard Chemical Company has suspended operations in its reduction plant, in the Paradox valley southwest of Grand Junction, until the close of the European war. This policy throws about 180 men out of employment since the vanadium mines supplying this mill with ore were also shut down. But there is a healthy condition in the tungsten camps of Boulder county and it is estimated that the daily production of WO_3 has a value of about $8250.

Recent Transfer of the Independence Mine to the Portland Gold Mining Co. created a stir in the Cripple Creek district. Citizens believe that the deal will prove advantageous to the district as a whole in that operations will require more men than heretofore. The Independence mill was closed down preceding the transfer, the dump material having practically all been treated. There is a scramble for leases in the Independence ground and it is probable that the new owners will grant such privileges upon the same terms as prevail in Portland leases. The deed making transfer of ownership states the total consideration as $325,000.

The Mineral Production of Colorado for first half of 1915 shows little change. Gold production has been somewhat greater than for the corresponding half of 1914, this being due to the marked activities in the Cripple Creek district and to an increased dredging business at Breckenridge. Silver output remains nearly constant. Notwithstanding recent high prices for lead and zinc, figures show that the production of neither metal has risen materially up to this time. Tonnage of ore in Cripple Creek has been increasing every month since last fall. The estimated tonnage for June is 81,430 with an average gross value per ton of $16. It is predicted that, before the close of 1915, the district will be producing 100,000 tons per month.

To Comply with the Workmen's Compensation Law passed by the last session of the legislature, employers of Colorado, especially those engaged in mining and metallurgy, have negotiated with insurance companies for rates. On June 29, thirty managers of metal mines met at the Capitol building to discuss their findings in this matter and they arrived at the conclusion that they would either organize a mutual insurance company or secure their insurance directly from the state compensation fund, if the old-line companies that had attempted to force high rates did not recede from their octopus-like attitude. A committee, consisting of Fred Carroll, state commissioner of mines, D. W. Strickland, attorney, Ex-Gov. Jesse F. McDonald, Leadville, R. M. Henderson, manager of Wellington Mines Co., Breckenridge, and C. E. Anderson, Aspen, was selected to conduct final negotiations with the insurance concerns or to proceed with other schemes. Subsequently to conferring with this committee, the state industrial commission announced that it would approve a rate

of $3.73 for all underground workers and a rate of $2.39 for all surface workmen, this amounting to a reduction of practically 10% from rates that had previously been insisted upon by the insurance concerns. Where medical treatment is not included in indemnities, the above rates will be further reduced 25%. Now the coal-mine operators are busy along similar lines. Insurance companies insist upon a premium of $7.49 per hundred dollars of payroll in coal mines. Appeal to the state industrial commission by the coal operators resulted in a statement from the commission that it would approve a minimum rate of $6 per $100 of payroll. The operators believe they can form a mutual insurance fund and make money at the $6 premium rate.

SALT LAKE CITY—July 9

The Utah Copper Co.'s Output for the first five months of 1915 amounts to 52,484,908 lb. copper. Production has increased from 8,009,646 lb. in January to 14,053,765 lb. in May, which is the largest month's production in the history of the company. This is an increase of about 75%. The June output was larger, exact figures are not yet available. There are at present 1590 men on the payroll at the mine, 1500 men at the mills, and 250 in the employ of the Bingham & Garfield railroad—all told 3340 employees, who are paid over $200,000 a month in wages. The production in April and May amounted to 26,168,913 lb. copper as compared to 26,415,995 lb. during the first quarter.

Enterprising Park City Men have erected on Lincoln highway parting of roads east of camp a big sign reading: "Only seven miles to Park City, Utah's greatest silver-lead mining camp, elevation 7000 feet. Population 4500. Total mineral production $150,000,000. Dividends paid to stockholders over $45,000,000. See the wonderful mines, big reduction mills and a modern city." The sign has already brought scores of transcontinental autoists to camp. Many are attracted by the wonders of mining on a big scale and they are stopping over and visiting the mines, and incidentally leaving a little money at the hotels and restaurants. But better still, they are carrying away good words for the old camp, which is considered incalculable in dollars and cents.

GOLDFIELD—July 6

The Goldfield First-Aid Society has been organized with 16 charter members, all miners employed in the local mines. These men have been under instruction of C. S. Arthurs of the U. S. Bureau of Mines, for several weeks, in first-aid and mine-rescue work, and it was upon his suggestion that the organization was formed. The men have made excellent progress and have now two efficient teams capable of performing first-aid and mine-rescue work for the Goldfield district.

SEATTLE—July 6

Large Cleanup on Tolovana has recently been brought into Fairbanks by Harry Patterson operating a lay in deep channel claims on the third tier of the right limit, opposite claim No. 5 Above Discovery, a claim on Livengood Creek. It amounted to about $2500 in coarse gold. There are many nuggets weighing from $5 to $10. It is estimated that he has taken out about three fourths of the gold from his dump, the remainder of which cannot be sluiced on account of the lack of water. The largest previous cleanup was $180.

The Output of the Fairbanks Placer Mines for the first six months of 1915 was $300,000 greater than for the corresponding period last year. This was due almost entirely to the earlier season and the abundance of water. The greatest benefit of the lengthened operating season is to the opencut mines, which were handicapped by the backward season and the cold, wet weather last summer. Harry Atwood, on 5 Below Discovery, Pedro Creek, and Wm. Goodrich, on 3 Below, started sluicing in the latter part of May, whereas it has rarely been possible in the past to start before the first of July. Unless dry weather interferes by cutting off the supply of sluice water during mid-summer, the opencut mines should have the best season in the history of the camp.

Broad Pass Country Is Showing Well under prospecting, according to many who have come out for new supplies. Highly encouraging results have been obtained by practically all operators now working in the district on lode claims on the mineralized zone which penetrates the district for an unknown length. The indications are that the camp will be one of the richest in the north. The gold occurs with arsenides. W. E. Dunkle, a mining engineer representing the Guggenheims, is developing a group of claims which the big syndicate has taken under option to purchase at a large figure. The Guggenheims have options on some 20 other claims in the Broad Pass country. There are about 50 prospectors in that district now.

WALLACE—July 7

Cœur d'Alene Mines Cut in on Power from Thompson Falls Plant—The Frisco mine and mill, the Morning mine and mill, the Greenhill-Cleveland mine and mill, and the Tamarack mine and mill began to use power from the Thompson Falls plant July 1. The first three properties belong to the Federal Mining & Smelting Co. The litigation which preceded the use of the Montana current has attracted widespread attention but it was not generally known that the power line had been constructed. This work has been going on for the past year. The use of the Montana power is the direct result of the excessive rates charged by the Washington Water Power Co., which has had a monopoly on the power throughout the Cœur d'Alene district. Repeated efforts on the part of the mining companies to obtain a lower schedule always met with failure. Litigation in the state courts and before the State Public Utilities Commission was won by the mining companies and the state legislature enacted a provision to meet the situation in this district whereby the mining companies could build power lines to the state line to receive outside power providing that they would not become selling agents for the power. The defense of the power company was that they could not sell their current at a lower rate and operate at a profit. Since the new power is being used however new contracts are being offered at greatly reduced rates by the Washington Water Power Co.

The Continued Idleness of the Hercules Mine since the departure from the district of the representatives of the A. S. & R. Co. is regarded as an indication that the efforts to settle upon a new smelting contract for the Hercules ore have been abandoned. The old contract for the Hercules ore was at $14 for freight and treatment and, the lead content to be settled for at the full New York price for lead. This netted the Hercules company about $13 per ton more than the other companies for the same grade of ore. The Bunker Hill company has a long time contract but the terms are to be revised every five years and the revision to be based on the average of all contracts in the district. If the Hercules was given the same contract as they had had before it would have meant a material reduction by the smelting company on the Bunker Hill ore. It is believed that if the negotiations have been abandoned, the Day interests who control the Hercules will construct a smeltery in the Cœur d'Alene or might reconstruct the old Northport smeltery. They have holdings of several thousand acres near Osburn which were acquired recently. It is hardly possible that the Hercules mine would remain closed during the construction of a smeltery. In case the mine were operated the ore would have to be stockpiled unless some temporary smelting facilities could be obtained. The Northport smeltery might possibly be utilized in this case or the old Panhandle smeltery at Ponderay, four miles from Sandpoint, might be rehabilitated and the plant operated until the plant at Osburn could be constructed. There is a good water supply, and lime and coke are all that would have to be shipped in. There would only be a 3-mile haul for the concentrates from the mill and a 10-mile haul for the crude ore from the mine, both hauls would be downgrade.

JOPLIN—July 10

Strike Situation—East of the Missouri-Kansas state line the ore production this week did not exceed 800 tons, the strike extending to all the mines of Oronogo, Duenweg, Webb City, Alba-Neck and Joplin. In Kansas and Oklahoma no effort was made to extend the strike. Mines were started Thursday, Friday and today on the old scale of wages, and there are more than enough of the striking miners ready to go to work. It is estimated that 75% to 80% of the strikers will return to their old jobs Monday morning, and some of them are sore enough to cause trouble if any strikers attempt to interfere with their going to work. Representatives of the Metal Mine Workers Union were haranguing the men today, with the assertion that they can get $100,000 to back them up in their strike. It is asserted that all but the floating element are ready to return to work. The operators have made arrangements for a sliding scale of wages, based on the average base price of ore the preceding month, this rate to hold for one month. No trouble is anticipated.

TORONTO—July 9

Bees and Smeltery Smoke—Ten farmers in the neighborhood of Thorold, Ont., have brought actions against the Conlagas Reduction Co., for amounts varying from $950 to $10,000, on the ground that gas from the company's smeltery at Thorold has killed all the bees within a radius of several miles. They also allege that the poisonous vapors kill vegetation, rendering farming or fruit-growing in the vicinity of the smeltery practically impossible.

The Mining News

ALASKA

KENNECOTT COPPER (Kennecott)—Copper production in June was approximately 9,000,000 pounds.

HUBBARD ELLIOTT COPPER (Strelna)—A. G. Elliott on way to property, where he will plan installation of new equipment at Strelna on Copper River.

ALASKA COPPER CORPORATION (Strelna)—H. W. Du Bois, consulting engineer, of Philadelphia, is at property to go over ground in preparing plans for production on larger scale.

ALASKA-JUNEAU (Juneau)—J. H. McKenzie announces that 9000-ft. adit tunnel now being used to deliver ore to company's pilot mill may be double-tracked when new mill is built.

MOTHER LODE COPPER (McCarthy)—Is to drive lower adit tunnel to ore. President Godfrey is at present in New York on business in connection with mine.

PORCUPINE (Porcupine)—Large cleanup, first this year, has been made on this property consisting of $17,000 in gold dust, result of 15 days' labor of 22 men. Some rich ground has been opened up and force is being increased with view of rushing development.

ALASKA GOLD (Juneau)—Manager B. L. Thane announces that work will be continued this year and during winter to prepare Kensington mine for producing ore for 500-ton mill to be started in spring. Mine is situated at Berners Bay, about 60 miles from Juneau. Work being started on transmission line to bring power from new Annex Creek power installation now in process of construction to Thane. Sam Vuch, discharged miner at Perseverance mine, was given one year in jail for assaulting shift boss with candlestick underground.

ARIZONA

Greenlee County

ARIZONA COPPER (Clifton)—According to final court decision company must pay to Greenlee County $40,000 of back taxes.

SHANNON (Clifton)—Copper production in June was 1,018,000 lbs. which was 6000 lbs. less than in May. Average price received for copper sold in June was 19.47c.

Mohave County

LOST BASIN (Kingman)—Recently organized to take over Scanlon mine will immediately build first unit of 100-stamp mill.

UNITED EASTERN (Oatman)—Plans to begin construction of mill within next few weeks. On 565 level free gold has made its appearance in vein material.

ARIZONA SOUTHWESTERN (Yucca)—Shaft at Copperville being unwatered and will be sunk to 500 level. Mill now being overhauled preparatory to resumption of operations.

Pinal County

MAGMA COPPER (Superior)—Ore reserve said to be 95,000 tons, averaging 7.6% copper and $4 to $5 in gold and silver. Company hopes to develop porphyry orebody at depth. Full capacity of plant will not be reached until completion of three-compartment shaft about October.

AMERICAN SMELTING & REFINING CO. (Hayden)—Has taken over Christmas mine near Hayden. Will construct aërial tramway 1½ miles long, a high power transmission line and make other improvements. S. H. Sterman is superintendent.

Santa Cruz County

DUQUESNE M. & R. (Duquesne)—Work being rushed on alterations of mill at Washington Camp, installing new flotation machinery. Plant will have 100 tons capacity and will be ready for operation soon.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Reported that new oreshoot in 2300 level is wider and contains more gold than in upper levels.

Eldorado County

MONTEZUMA (Nashville)—Good progress being made in deepening shaft. Property is being developed by owners of Plymouth Consolidated at Plymouth, Amador County. J. F. Parks is superintendent of both mines.

Kern County

ANTIMONY CLAIMS have recently been located in Greenhorn Mountains by Miles R. Martin of White River and Pat McCloskey of Bakerfield. Samples are reported to assay 85%. Property is being prospected.

BUCKBOARD (Randsburg)—Fraser Bros. have purchased lease. Former leasers worked only few weeks and extracted 31 tons of ore that milled $21.75 per ton. Mine contains some good orebodies.

KERN COUNTY LAND CO. (Bakersfield)—Antimony mine in San Emidio mountains being prospected with view to operating during summer time. Mine was located several years ago and is reported to contain valuable deposits of antimony.

Mendocino County

MANGANESE DEPOSITS recently discovered at Potter on Busch ranch will be developed by Eastern men interested through Dr. Lewis Lee.

Mono County

NEYLON (Laws)—Controlling interest taken over by Joseph S. Giroux, of Ely, Nev. New road is being built to mine situated about ten miles northeast of Laws.

MAMMOTH (Mammoth)—Prospective purchasers examining mine which was formerly producer. Ore low-grade but it is reported that it can be worked with profit if it will average $4 per ton.

Placer County

FEDERAL DRIFT MINING CO. (Dutch Flat)—Agreement between surface property owners and mining company has been practically completed for mining operations beneath town. Only three owners have withheld their signatures. It is expected to start this new tunnel immediately. Recent bedrock strike made by company half mile below town added to interest in undertaking. Dutch Flat was, in early days of California mining, one of richest hydraulic camps and it is evident that there is large amount of drift gravel beneath town. Company recently installed 4-stamp mill and an electric device for saving gold.

Siskiyou County

JUDHIGHT (Fort Jones)—A. H. Lindsay of Sacramento has bonded this property on Indian Creek. Initial work will be driving of 600-ft. tunnel. Mine was rich producer in early days.

Trinity County

GOLDEN JUBILEE (Coffee Creek)—Since reopening mine which closed down several years ago, good grade of milling ore has been disclosed and it is expected to start mill soon. Mine was large producer when in former operation.

Tuolumne County

NYMAN MINES (Jamestown)—Charles E. Schafer, manager, has received authority from owning company at San Francisco to begin unwatering Santa Ysabel mine.

SPRINGFIELD TUNNEL (Sonora)—New tunnel is now in 2400 ft. The last 104 ft. was driven in 19 days. Raise at 2230 ft. mark cut gravel and will be initially used as an airshaft. At 2800-ft. point, another raise will be made.

COLORADO

Boulder County

BOULDER TUNGSTEN PRODUCTION CO. (Boulder)—Development work is in progress in 1905 shaft, under direction of Fred H. Nye, superintendent of mines. Pay ore has been opened on 125 level and crosscutting is in progress to develop Midnight vein. It is company's plan to continue work in shaft and eventually make connection with tunnel driven from Boulder Creek.

Clear Creek County

CLEAR CREEK COUNTY SHIPMENTS during June were 88 cars of crude ore and concentrate. Argo mill purchased ore to value of about $26,000; Chamberlain sampler at Idaho Springs bought ore worth $25,000; and Georgetown sampler paid out $12,000 in settlements, making total of $63,000.

San Juan County

HIGHLAND MARY, SHENANDOAH AND TRILBY, old producers of copper-silver ore, have been consolidated and will hereafter be operated under one management. Shenandoah is under lease to J. B. Houston. Ores from these mines are amenable to flotation and a plant of this sort is contemplated.

SILVER LEDGE (Silverton)—Mill is running steadily concentrating lead-zinc ore accumulated during last winter's operation of mine.

BAGLEY MILL (Animas Forks)—Arrangements are made for starting up this old plant to treat ores from Hermes and other mines. Dan McNaughton will be superintendent.

EMMA (Silverton)—John Mattivi has begun sending out his accumulated winter stock of high-grade lead-silver ore by jack-trains; trails in Ice Lake Basin having been recently opened for season.

MAYFLOWER (Silverton)—American Ore Flotation Co., lessees, has reopened this mine and is exploring it. Body of sulphide ore 9 ft. wide carrying silver and gold is under development. Oil flotation is in continual use at the Silver Lake mill, treating ores mined in Mayflower and other leased mines. D. L. Thomas is metallurgist and Philip M. Collins is mill superintendent.

San Miguel County

TOMBOY (Telluride)—Mill ran 29 days in June; crushed 11,500 tons ore yielding $48,700 bullion and $54,500 concentrates. Operating profit $42,500.

COLORADO MANGANESE MINING & SMELTING CO. owns 10 claims in Dry Creek basin from which it ships very rich ore running less than 1% iron. Ore is hauled 40 miles in wagons to Placerville. Plans are made to maintain shipment of 25 tons daily. This very pure oxide has a ready market with manufacturers of electric batteries.

Summit County

FOUR DREDGES of district are working steadily. Estimated recovery of gold during June was $80,000.

DUNKIN (Breckenridge)—Shipped 50 tons carbonate ore to Chamberlain sampler. Ore runs about 35 to 40% lead, 15 oz. silver and 1 oz. gold. Lessees are O. K. Gaymon, of Denver; J. A. Sumner, of Salt Lake City; and Thomas H. Knorr and W. W. Wharton, of Breckenridge. Lawsuit with Queen Mining Co. over extra-lateral rights has been adjusted out of court and operations will be pushed.

Teller County

STRATTON'S INDEPENDENCE (Cripple Creek)—Cable advices give May production 4743 tons ore averaging 8 dwts., 13 grains; low-grade mine and dump ore milled 9617 tons.

LAST DOLLAR (Altman)—Lessees Crumby and Gibbons, who control ground between 1000 and 1200 levels, have opened vein on 1200 level that is 2 ft. wide and averages $30 per ton.

ORPHA MAY (Victor)—Dump is being worked over by Garstin and associates who have installed screening and washing machinery and are shipping product worth about $20 per ton.

MARY McKINNEY (Anaconda)—Mine practically closed down during installation of new electric machinery. Repairs to shaft also being made and it is probable that shipments of ore will be prevented for two months.

AJAX (Victor)—In Worthington lease in Block 13 orebody has been opened for distance of 50 ft. which has width varying from 2 to 5 ft. and test shipments of higher grade product range from $100 to $200 per ton in gold.

GRANITE (Victor)—Leasers Loss and Kaser are developing block of ground on 1200 level. New ore shoot has been opened which has width of 2 to 4 ft. and assays $30 per ton. Raise in ore shoot indicates that vein is becoming wider toward surface.

UNITED GOLD MINES (Victor)—In the various properties controlled by this company, at least 20 sets of leasers are working and shipments are being made from Trail and Trachite, on Bull Hill, May B on Squaw Mt., and the W. P. H. and Damon on Ironclad Hill.

C. O. D. (Cripple Creek)—This mine produced heavily in former times, but was closed down because of drainage difficulties. It has been secured by parties who have incorporated C. O. D. Consolidated Mining & Development Co. Col. T. B. Burbridge, James E. Hanley, Virgil Mann and Frank Vetters are among incorporators. Five sets of leasers are already working underground, while one set is preparing to handle mine dump.

IDAHO

Custer County

LOST PACKER (Mackay)—Smelting plant on Loon Creek being prepared for blowing in. Apparatus for 50-ton flotation plant is arriving.

EMPIRE COPPER (Mackay)—During June 169 cars, about 8450 tons of ore, were shipped to Utah smelters. On July 5, new record made at mine by shipping 18 cars, about 900 tons. Ralph R. Osborn is superintendent.

Shoshone County

C. & R. MINING (Wallace)—Edward Roberts, manager, will immediately purchase new compressor and other equipment for mine.

HORST-POWELL (Little North Fork)—Crew of 30 men are stoping and developing this copper property. Transportation difficulties have been solved and crude ore shipments will begin at once. Plans for erection of 150-ton mill have been completed.

SNOWSHOE (Mullan)—North-and-south fissure recently encountered has been followed for distance of 160 ft. and drift shows from 8 in. to 2 ft. of high-grade copper ore entire distance. Strike was first made at point 1600 ft. from portal of No. 2 tunnel and has vertical depth of 650 ft.

MICHIGAN

Copper

KEWEENAW (Calumet)—Loading station is being cut in Keweenaw at ninth level. Openings show good copper.

WINONA (Winona)—Is milling 600 tons per day at this time and is adding to milling and mining force daily.

CHEROKEE (Houghton)—Resumption of operations at Cherokee is expected in short time, both drilling and trenching.

FRANKLIN (Houghton)—Large compressor is in commission and production will be increased this week to 1000 tons daily.

MOHAWK (Mohawk)—Mohawk's new shaft rock-house will be in operation within month, if progress in construction continues at present rate.

NEW ARCADIAN (Houghton) — New Arcadian's further development in amygdaloid lode in south drift at 9th level shows as good if not better grade of milling rock than shown anywhere in mine.

ONECO (Hancock)—An assessment is expected on Oneco, if New Arcadian developments continue as sensational as in past few weeks. This company has 70,000 shares upon which $8 per share has been paid in.

AHMEEK (Ahmeek)—Sensational stories of rich strikes in exploratory drilling are untrue. One diamond drill is working. This drill is taking the first step in a cross-section. Yesterday it struck ledge, so utter absurdity of turning out a core from famous Calumet conglomerate is realized.

WYANDOT (Houghton) has unwatered shaft and is continuing drifts on 9th level with fairly good showing. They are making drill tests at present and orders are being placed for new machines. Resumption of sinking in winze will follow shortly. Assessment called last week was generally anticipated by shareholders.

NEW BALTIC (Houghton)—Shareholders of New Baltic are apparently pleased with plans for development of property through New Arcadian, and assessment plan is generally meeting with approval. In meantime development work at Arcadian continues to show most excellent stamp rock with each new blast.

Iron

TRADERS (Iron Mountain)—Mine will not be operated this season. It is an openpit and has shipped for several seasons.

INDIANA (Iron Mountain)—Several small lenses of high-grade ore have recently been found here. Considerable development work is being carried on. Regular shipments are now being made to docks at Escanaba. The inflow of water is greater than it was. About 800 gal. are now being taken care of. Eighty men are employed underground and on surface.

MAAS (Negaunee)—Cleveland-Cliffs Iron Co. has started shipping big stockpile here. Mine has been idle since last fall. There are about 300,000 tons of ore in stock. The bessemer is now being moved. This company has about 3,000,000 tons in stock on Marquette range. The sales for this year are close to 2,000,000 tons. Part of ore in stock runs high in silica and cannot be easily disposed of at this time. Production of the company's mines at present time is at rate of 1,500,000 tons per annum.

CHARCOAL IRON CO. OF AMERICA (Marquette)—This is title of company formed to take over Lake Superior Iron & Chemical Co. This latter company was placed in the hands of a receiver two years ago, when iron market became dull. Holdings were sold in Federal court in Marquette for $4,000,000. Bondholders bought in property and will issue preferred and common stock to holders of bonds of Lake Superior Iron & Chemical Co. Management will remain the same and general offices will be maintained at Marquette. At present time only two of the company's six furnaces, Boyne City and Newberry plants, are in blast. Other plants are located at Chocolay, Ashland, Manistique and Elk Rapids. Ashland and Manistique furnaces will be blown in as soon as repairs now under way are completed. Concern has large timber holdings in upper Michigan and Wisconsin and owns lease of Yale mine on Gogebic range, which is owned by J. M. Longyear.

MINNESOTA

Duluth

MINNESOTA STEEL—Official announcement made that completion of Minnesota Steel Co.'s plant will be rushed. Already 500 men have been employed. Actual production of steel will begin by November. In addition, erection of 100 more employees' residences is planned.

Cuyuna Range

CUYUNA RANGE—On North Range, Rowe mine still leads in activity, having two hydraulic units at work stripping. Their concentrator will be ready by August 1. Hill Crest and Mahnomen stripping operations are progressing, as is also the stripping of part of Armour No. 1 orebody. Pennington pit is unwatered, although no work is being done. Inland Steel Co. is operating its Thompson pit and Armour No. 2 mine. Concentrator at Thompson is satisfactorily producing 600 tons daily. Circular concrete shaft at Croft mine is down 145 ft., being 40 ft. into ledge. Kennedy, at Cuyuna, is shipping 750 tons from skips, and will ship its 100,000-ton stockpile. On South Range, Wilcox is shipping steadily, and increasing its production. Brainerd-Cuyuna, at Brainerd, hoisted its first ore on Sunday, July 4, on which date the stockholders held a picnic on property.

MONTANA

Fergus County

SPOTTED HORSE (Maiden)—Plans being made for construction of cyanide plant. Property said to have been one of biggest gold producers in state since its discovery in 1881.

Hill County

HAVRE OIL AND NATURAL GAS (Havre)—Reports from Havre indicate that gas was struck June 3 in third well drilled by company, which flows between 7,000,000 and 10,000,000 ft. of gas every 24 hours. All efforts to cap flow failed because of great pressure of gas. Noise of escaping gas is heard mile away and precautions have been taken to prevent fire. Two lengths of casing were extended above ground so as to carry the gas further from danger. Town of Havre wild with excitement over strike.

Lewis and Clark County

SCRATCH GRAVEL DISTRICT NEAR HELENA—Operations in this district, which have been carried on by Helena Mining Bureau, have been discontinued for reason that claims leased by the Bureau have not come up to desired expectations. Machinery which had been installed on these claims is now being moved to near Clancy, where Bureau will start development work on Silver King claim. Of four claims developed by Bureau, Hawkeye mine, within city limits of Helena, is only one which has shown enough promise to warrant continued operations.

RICH STRIKE IN DRY GULCH NEAR HELENA—One of the richest strikes made in recent years in the gold district tributary to Helena is reported from a property a mile and a half south of Helena in Dry Gulch. Property is owned by Peter Rowan. There is a 450-ft. tunnel on the claim, in which a vein was discovered which is believed to be the much-sought-for "mother lode." Vein averages in width from 3 to 5 ft. and average values in previous operations ran from $7 to $8 a ton. Claim adjoins the Jumbo, a famous gold producer a number of years ago.

A. B. MELZNER VS. BRITISH-BUTTE MINING CO (Butte)—June 25 Judge McClernan finished hearing testimony in case of A. B. Melzner against W. E. Ward on injunction to prevent

Ward from interfering with big De Hora dredge at Rocker, which Melzner bought in at sheriff's sale last February, ordered to satisfy a judgment against the defunct British-Butte Mining Co. Judge McClernan granted temporary restraining order to prevent further interference with dredge by Ward, who had started to dismantle with apparent intention of selling it for scrap. Order will hold good until the final trial and determination of case involving ownership.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Will proceed at once with development of Butte-New York properties of which Butte & Superior owns controlling interest. Butte-New York controls Butte-Milwaukee group which lies east and north from Butte & Superior's Black Rock mine. Butte-New York claims are zinc properties. Development will be carried on from 1200 and other levels of Black Rock.

MINING ACTIVITY IN WALKERVILLE DISTRICT—Great deal of work being done in and around Walkerville where some of first mining was done in Butte. Many leasers are busy developing and shipping ore and steps are being taken to unwater the old Lexington mine. Work has been started to repair the shaft and install pumps on the 300 and 500 levels. Contractors have been at work deepening Moose shaft, an auxiliary of Badger State. Work is being done to connect these shafts at a depth of 1300 ft. George Stephens, mayor of Walkerville, is making weekly shipments of gold and silver ore from Moulton. Development work is continued on Home Run mine and Frank Whitman is shipping ore regularly from his lease on Fraction which carries high silver and gold. Sam Hoar has several men working on his lease on Belle of Butte and is making preparations for regular shipments.

NEVADA

Elko County

BLUSTER CONSOLIDATED (Jarbidge)—New mill, started last month, now treating 40 to 45 tons daily; treatment by amalgamation.

ELKO MINING (Jarbidge)—Alpha mill closed down indefinitely. Small amount of development work will be continued in hope of opening more ore.

Nye County

TONOPAH ORE PRODUCTION for week ended July 3 was 10,100 tons valued at $207,760, compared with 10,642 tons week previous. Producers were: Tonopah Belmont, 3547 tons; Tonopah Mining, 2450; Tonopah Extension, 1820; West End, 1002; Jim Butler, 1100; North Star, 107; and miscellaneous leasers 74 tons.

MONITOR-BELMONT (Belmont)—New mill being constructed will have ten 1600 lb. stamps and one 6x10 tubemill. Flotation equipment will also be included. It required 18 horses 8 days to haul tubemill from Tonopah, distance of 50 miles.

Storey County

COMSTOCK PUMPING ASSOCIATION (Virginia)—Repairs finished to east crosscut drain on the 2700 level.

YELLOW JACKET (Gold Hill)—Mill received 1005 tons of dump rock. One bar of bullion shipped to smeltery.

UNION CONSOLIDATED (Virginia) — West crosscut on 2650 level in porphyry and quartz. Reopening north drift on 2500 level.

CONSOLIDATED VIRGINIA (Virginia)—Jointly with Ophir on 2500 level old main north drift reopened to Mexican line. Resumed work in east crosscut to 2700 level winze.

MEXICAN (Virginia)—Important prospecting started in west crosscut on 2700 level. On 2500 level ground in main Comstock reopened. Mill crushed 155 tons, averaging $14,25 per ton.

OPHIR (Virginia)—Saved 323 cars of mill ore from Central tunnel and shipped 250 tons to mill. Central tunnel continues to show large tonnage and 8-ft. body of quartz to be explored to the north. Machine drills are to be installed to continue Andes crosscut.

NEW JERSEY

Sussex County

NEW JERSEY ZINC (Franklin Furnace)—A 250% stock dividend has been declared payable on or after July 21 to stockholders of record at noon July 10. This increases the capital stock to $35,000,000.

NORTH DAKOTA

Mercer County

DRILLERS ENCOUNTERED GAS at depth of 75 ft. 1½ miles west of Expansion.

UTAH

Juab County

TINTIC ORE PRODUCTION during the first half of 1915 amounted to total of 2770 carloads estimated at 138,500 tons, valued at $3,460,000. Total for June was 568 carloads, estimated at 28,400 tons, and valued at $710,000. These figures compare with total yearly shipments from camp in 1914 of 6094 carloads, and fall little below average. Chief and Mammoth in June, exceeded any of their other monthly production so far this year. There were 22 shippers in June and 34 in first half of 1915. The individual productions for first half of 1915 are in carloads: Sioux mill dump, 341; Iron Blossom, 502; Chief Consolidated, 335; Mammoth, 110; Centennial-Eureka, 530; Eagle & Blue Bell, 245; Gemini, 103; Grand Central, 83; Dragon Consolidated, 91; Victoria, 36; Gold Chain, 42; Beck Tunnel, 34; Bullion Beck, 35; May Day, 61; Carisa lease, 16; Sioux Consolidated, 18; Uncle Sam, 12; Opohongo, 9; Colorado, 30; Eureka Hill, 25; Godiva, 9; Yankee Consolidated, 19; Black Jack, 4; Tintic Standard, 2; Lower Mammoth, 62; Ridge & Valley, 1; Utah Ore Sampler, 3; Minnie Moore, 4; Utah Mining-Continental, 3; United Tintic, 1; Clift lease, 1; Dubuc lease, 1; Salvador, 1; Copper Queen, 1.

OHIO COPPER (Bingham)—New leasing company is working at capacity, treating 2400 to 2500 tons of ore daily.

GRAND CENTRAL (Mammoth)—Shipments are being made from nearly all levels between 600 and 2200. Copper ore of good grade is coming from lower workings. June output amounted to 18 cars.

Piute County

MINERAL PRODUCTS (Marysvale)—Construction on the new mill to treat alunite for potash has been started. Work is under contract to Westinghouse, Church, Kerr & Co. Roads in cañon are being put in shape for autotrucks, and tramway mile long is to be built to loading station in Cottonwood Cañon. About 20 men are employed at mine on development. L. K. Kennedy will be mine superintendent.

Summit County

PARK CITY ORE PRODUCTION for month of June shows total of 8759 tons from five principal shippers and approximately 500 tons from others, making total for camp of 9259 tons, estimated at $370,360. Total for first half of 1915 is approximately 50,000 tons. Estimated valuation is $2,000,000 for six months. These figures may be compared with a total for the camp in 1914 of 75,000 tons, and is considerably above half-year average production. Principal producers were: Silver King Coalition, 22,498 tons; Daly-Judge, 11,636; Silver King Consolidated, 4594; Daly West, 7391; Ontario, 521; Daly, 520; D. W. Quincy, 100; American Flag, 25 tons.

WASHINGTON

Okanogan County

ARLINGTON MINING CORPORATION (Okanogan)—H. I. Stolfire states that company plans to install considerable new equipment in Arlington mine.

Stevens County

COPPER KING (Chewelah)—Judge W. H. Jackson, in the Superior Court of Colville, ordered accepted bid of $125,000 for property by J. W. Douglas of Orient. This will net shareholders about 5c. per share. Property was in receiver's hands.

WISCONSIN

Zinc-Lead District

MINERAL POINT ZINC (Mineral Point)—Construction of new sulphuric-acid plant at Mineral Point is under way. New methods will be used to protect surrounding vegetation from gas fumes.

ENTERPRISE (Platteville)—H. E. Stephens and Chas. Kistler are preparing to operate Enterprise roaster for custom work.

NATIONAL SEPARATING CO. (Platteville)—New equipment is being installed which will increase capacity of roasting plant 50 per cent.

VINEGAR HILL ZINC (Platteville)—New milling plant on Kittoe Mine at Benton has been placed in operation.

FIELD (Scales Mound)—New 400-ton mill has just been completed on Thompson lease at New Diggings.

UTT-THORNE (Platteville)—This company has purchased roasting plant of Wisconsin Separator Co. at Benton and will engage in custom roasting.

CANADA

Alberta

SOUTHERN ALBERTA OIL CO. (Calgary Oil Field) — President Wm. Livingston announces that this company has flowing well. Rising oil burst safety valve at top of hole and is flowing over surrounding area. Depth of well is 3527 ft. and pressure when valve blew off was 350 lb. per sq.in.

British Columbia

BRITISH COLUMBIA COPPER (Greenwood)—After idleness of ten months Greenwood smeltery has resumed operations by blowing in one blast furnace. About 50 men will be employed at plant and 50 more at Mother Lode mine. Operations will be brought up to full normal capacity as rapidly as possible.

Nova Scotia

DOMINION STEEL CORPORATION—No. 7 blast furnace was blown in July 5, making four furnaces now in operation. Production for June: Pig iron, 22,552 tons; steel ingots, 28,680; rails, 13,044; rods, 6435; bars, 797; wire and wire products, 3167 tons.

Ontario

LUMSDEN (Cobalt)—Operations have been resumed on a small scale. Crosscutting will be undertaken on 50-ft. level in hope of cutting Timiskaming vein.

DOME (South Porcupine)—General manager has given out statement to effect that rich ore struck by diamond drilling when opened up by drifts is in richness and extent beyond expectations. He says "The mine-run showed better than 27,000 tons milled with bullion production of about $121,000," and concludes by saying "we have openings now in the mine in such high-grade ore that we can make almost any production which you might feel justified in wishing to maintain."

SOUTH AMERICA

Chile

BRADEN (Rancagua)—Production for June was 2,542,000 lb.. Treated 91,000 tons ore averaging 2.1% copper. Average extraction was 77.21%.

AFRICA

Rhodesia

TOTAL PRODUCTION OF METALS in Rhodesia for the five months ended May 31, is reported as follows: Gold, 362,471 oz.; silver, 71,397 oz.; copper, 1313 tons; lead 12 tons. The output of other minerals was: Chrome ore, 17,543 tons; asbestos, 231 tons; coal, 151,558 tons. There were also 33 carats of diamonds reported.

The Market Report

Metal Markets

NEW YORK—July 14

All of the principal markets except spelter were dull during the last week, and were inclined to be reactionary, although the recession in quotations was but trifling.

Copper, Tin, Lead and Zinc

Copper—Exactly the same conditions continue to exist as were reported last week, but there was less business done. Such as was done by the principal producers was for special shapes, special brands, special terms or otherwise that were in no way indicative of the market. On regular business they maintained their asking prices of 20@20¼c., regular terms, but it was admitted that the actual market was below that, and, in fact, copper was offered during the week by outsiders as low as 19½c., regular terms. On the whole, however, the market during the last week cannot be characterized as otherwise than merely nominal.

Copper Sheets are understood to have brought 25@26c. per lb. The principal manufacturer makes no base quotations. Wire is quoted at 21½@22c. per lb. at mill.

Copper Imports reported by the Department of Commerce for the month of May included 10,389,201 lb. in ore; 655,041 lb. in matte; 9,495,690 lb. pigs, bars, etc.; 745,867 lb. old, scrap, etc.; total, 21,285,799 lb. Exports for the month included 39,637,810 bars and ingots; 8,623,823 lb. rods and wire; 2,130,402 lb. plates and sheets; 750,906 lb. scrap, etc.; total, 51,202,941 lb. In addition there were exported 2910 tons ore and matte, containing by values approximately 153,220 lb. copper. This brings the total imports for the five months ended May 30 up to 43,929 long tons; exports, 134,405 tons.

Copper Imports for the week ended July 3 are reported by the Department of Commerce as follows: Metal, 5,236,918 lb.; contents of ore and matte, 759,585 lb.; total, 5,996,503 lb. These imports were nearly all from Chile, Peru and Japan. Exports of copper for the week were 7,171,707 lb.; the chief items being 3,859,650 lb. to Great Britain; 2,477,231 lb. to France; 672,000 lb. to Denmark.

The Consolidated Arizona Smelting Co. is reported to be doubling its smelting capacity at Humboldt, Ariz. This company is said to be making money now for the first time in its history.

Tin—Deliveries were rather large and there was some pressure to sell, which caused the price to recede a little, buyers being already well provided.

Exports of tin from the Federated Malay States five months ended May 31 were 20,599 long tons in 1914, and 19,270 in 1915; decrease, 1329 tons.

Lead—The principal producers maintained a price of 5.75c., New York, which was realized on some transactions, but there was a reappearance of lead from second-hands which was offered in considerable quantity at rather large concessions from the producers' price.

Spelter—Relatively little business was reported done by first-hands, but there was rather a large tonnage reported sold in trading business, considerable spelter being offered for resale. The conditions of these transactions were rather curious. A moderate tonnage of spelter was reported sold for export.

The London quotation for spelter continues unchanged at £100, but this quotation is purely nominal.

The number of new distillation furnaces being added at the Sand Springs smelting works is two. One furnace is being added at Chanute, and one at Bruce. The old plant at Nevada, Mo., is to be put in operation about the end of August with four Belgian blocks. E. V. Lanyon is building two Belgian blocks in connection with the east plant at Pittsburg, Kan., but on his own account.

The U. S. Steel Corporation is reported to be making good progress at Donora, Penn., with the construction of its new zinc and acid plant.

Exports from Baltimore for the week included 474,874 lb. zinc dross to Liverpool.

Spanish Exports of Metals and Minerals for the four months ended Apr. 30 are reported by the "Revista Minera" as follows in metric tons:

	Metals		Ores etc.	
	1914	1915	1914	1915
Iron	4,027	52,689	2,673,020	1,348,945
Copper	6,391	5,562	48,470	12,811
Copper precipitate	3,720	3,604	.....	.....
Lead	55,308	45,407	879	274
Zinc	502	1,400	29,958	5,194
Quicksilver	827	699	.....	.....
Manganese	.....	.....	5,913	2,326
Pyrites	.....	.....	1,070,727	461,764
Salt	.....	.....	201,600	144,268

Imports of coal for the four months were 455,159 tons, a decrease of 484,569 tons; of coke, 63,802 tons, a decrease of 62,699 tons.

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
			*19.45			5.57½	19.75
8	4.7650	47½	@19.55	38⅜	5.75	@5.67½	@22.25
			*19.30		5.70	5.55	20.00
9	4.7681	47⅜	@19.40	38⅞	@5.75	@5.65	@22.50
			*19.25		5.70	5.55	20.00
10	4.7675	47⅜	@19.35	38⅞	@5.75	@5.65	@22.50
			*19.25		5.70	5.55	19.75
12	4.7650	47⅜	@19.35	38⅜	@5.75	@5.60	@21.75
			*19.30		5.60	5.50	19.75
13	4.7663	47⅜	@19.40	38⅜	@5.75	@5.60	@21.75
			*19.30		5.60	5.50	19.75
14	4.7663	47½	@19.40	38	@5.75	@5.60	@21.75

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
8	22 5/16	77¾	79	93½	19.32	170	165½	23⅞	5.17	100	21.73
9	22⅛	77⅛	78¾	94	19.42	172	166½	24½	5.22	100	21.73
10	22⅛	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	22⅛	77⅛	79	93½	19.32	171¾	165½	25½	5.43	100	21.73
13	22½	78¼	79½	93½	19.32	172½	166¼	25 5/16	5.36	100	21.73
14	22 5/16	78	79¼	93½	19.32	171½	165½	25⅛	5.35	100	21.73

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

Other Metals

NEW YORK—July 14

Aluminum—The market has been fairly active, with some increase in sales. Prices are unchanged and firm, the current quotation being 32@33c. per lb. for No. 1 ingots, New York.

The latest London quotation for No. 1 ingots is £130@140 per long ton; the average being equal to 29.33c. per lb. The price is advancing.

Antimony—Fair sales are reported but the market is nervous and unsettled though there has been no material change in prices. Chinese and other ordinary brands bring 37½@40c. per lb. The special brands are nominal, 50@52½c. per lb. being asked for Cooksons.

Nickel is steady and unchanged at 40@45c. per lb. for ordinary forms, according to size of order. Electrolytic 3c. per lb. higher.

Quicksilver is strong and in good demand, with prices higher. New York quotations are $94 per flask of 75 lb. for large orders; $95@100 for smaller quantities, with sales chiefly at the higher figure. San Francisco price is reported by telegraph at $90@95 per flask, with business fair. London has had a sharp advance and the price is now £18 5s. per flask, with £18 2s. 6d. quoted from second hands.

Minor Metals—Current sales of bismuth are at $2.75@3 per lb. New York. The London price is quoted at 10s., or $2.40 per lb. there—**Cadmium** is quoted at 6s., or $1.44 per lb. in London; $1.50 per lb., New York.—**Tellurium** is reported sold at 80s., or $19.20 per lb. in London.—**Selenium** is quoted at $2@3 per lb. New York for larger quantities; $4.50@5 for retail lots.

Gold, Silver and Platinum

Gold in the United States July 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,173,799,069; in Treasury current balances, $206,526,508; in banks and circulation, $600,777,874; held by Federal Reserve banks against note , $12,445,564; total, $1,993,549,015. This is an increase of $78,763,019 over the June report.

Gold production of the Transvaal is reported by cable at 755,280 oz., or $15,611,638, in June. For the half-year ended with June it was $84,475,128 in 1914, and $91,114,352 in 1915; an increase of $6,639,224 this year.

Platinum remains quiet with moderate sales and quite steady. Dealers ask $37@39 per oz. for refined platinum and $41@44 per oz. for hard metal.

Our Russian correspondent writes that the market remains generally unchanged, but a slow decrease in prices is to be noted. The demand in Petrograd is good, but the difficulties in exporting the metal detain the business. At Ekaterinburg the speculators buy voluntarily small portions of platinum from the starateli. The quotations are: at Ekaterinburg, 8.20@8.30 rubles per zolotnik; in Petrograd, 33,000@33,200 rubles per pood, for crude metal, 83% platinum. These prices are equivalent to $31.02 and $32.44 per oz. average, respectively.

Silver continues quiet, with small fluctuations in price. Some silver is going to the East from San Francisco; shipments from New York are only moderate, but seem sufficient at present to satisfy the demand.

Exports of silver from London to the East Jan. 1 to June 30, as reported by Messrs. Pixley & Abell:

	1914	1915	Changes
India	£3,893,000	£2,647,000	D. £1,246,000
China	40,000	5,000	D. 35,000
Total	£3,933,000	£2,652,000	D. £1,281,000

Coined silver in the United States July 1 is estimated by the Treasury Department as follows: Standard dollars, $568,272,478; subsidiary coins, $185,293,874; total, $753,566,352. Of the standard dollars $493,459,000 are held in the Treasury against silver certificates outstanding.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 10

The base price paid this week for 60% zinc ore was $100@110 per ton. The base price paid for 80% lead ore was $70 per ton.

SHIPMENTS WEEK ENDED JULY 10

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	2,819,400	371,580	475,380
Year	97,973,430	3,868,470	14,261,270

Shipped during week to separating plants, 3,582,000 lb. zinc ore.

The net shipment of finished ore for the first six months of 1915 showed a gain of 18,513,630 lb. over the corresponding period last year.

JOPLIN, MO.—July 10

Blende, high price $112; base per ton of 60% zinc, premium ore $110; medium to low $105@90, in car lots. Calamine base per ton of 40% zinc, $58; average price, all grades of zinc, $100.04. Lead, high price $72; base $70@60 per ton of 80% metal content; average all grades of lead, $61.47 per ton.

SHIPMENTS WEEK ENDED JULY 10

	Blende	Calamine	Lead	Values
Totals this week.	4,814,370	185,580	1,335,420	$291,090
Totals this year..	303,970,400	26,144,080	46,101,670	12,667,270

Blende value, the week, $245,030; 28 weeks, $10,905,980.

Calamine value, the week, $5030; 28 weeks, $550,310.

Lead value, the week, 41,030; 28 weeks, 1,210,980.

Production of the Missouri mines in the district was not over 800 tons. The miners are now gradually returning to work and the strike is almost over.

OTHER ORES

Chrome Ore—The latest quotations in London are, per long ton: New Caledonia ore, 50% base, $27.60 per ton, with a scale of 60c. per unit for variations. Rhodesia ore, base 48%, $26.40, variation 48c. per unit. Baluchistan ore, base 50%, $27.60, variation 60c. per unit. New Caledonia and Baluchistan ores generally run over 50%; Rhodesia 2 to 3% below.

Iron Trade Review

NEW YORK—July 14

Activity continues in the iron and steel trades, largely due to the volume of export business placed, but in some degree also to improving consumption at home.

The rate of operations at the steel mills has increased, and some of them are working well up to capacity. The Steel Corporation June report of orders shows that its new business for the month must have exceeded deliveries by a considerable amount. The Corporation is now reported to be buying billets from outside mills to supply some of its plants in the East.

Pig iron seems to linger behind. The increase in production shown this month is mainly from the steel works furnaces, the merchant stacks having only a small gain.

Holding that tariffs filed by 11 railroads proposing charges for hauling slag from furnaces in western Pennsylvania, Ohio and West Virginia, do not conform to the act to regulate commerce, the Interstate Commerce Commission has handed down a decision ordering the tariffs stricken from its files. The commission says, however, it sees no reason why this disposal service must be performed gratuitously by the carriers. It makes it plain that it expects the railroads to file appropriate tariffs conforming with other requirements attending business of common carriers. These tariffs are expected to be regular and be more specific than those which were on file.

Exports from Baltimore for the week included 2,703,610 lb. billets and skelp steel; 3,466,919 lb. bars and wire rods; 2,631,730 lb. wire and 3,330,949 lb. pipe, all to Great Britain.

Pig Iron Production—The reports of the furnaces on July 1, as collected and published by the "Iron Age," show at that date 218 coke and anthracite stacks in blast, having a total daily output of 80,400 tons; an increase of 7800 tons over June 1. Making allowance for the charcoal furnaces the total make of pig iron in the United States in June was 2,408,500 tons; for the six months ended June 30 it was 12,248,400 tons. Of this total 8,960,700 tons, or 73.2%, were made by the furnaces owned and operated by steel companies. Production now is at the rate of about 29,500,000 tons yearly.

Exports of Iron and Steel for which weights are given in the returns amounted during May to 138,514 tons in 1914, and 262,844 in 1915; an increase of 124,330 tons, or 89.8%, this year. The larger gains were in bars and wire rods, billets and ingots, plates and wire.

PITTSBURGH—July 13

Conditions in the steel industry seem to be improving even more rapidly this month than they did in May and June, a remarkable showing considering that July and August are usually dull months in the industry. Bookings by the steel mills have been heavy thus far this month, comparing very favorably with June, and prices are stiffening more or less practically all along the line, even including such items as railroad spikes, chain, shafting, rivets, etc., which are usually slow in showing price advances.

The pig iron and coke markets have become excited and there are predictions of almost sensational price advances. The pig iron market, however, is quite unsettled, on account

of the Lake front furnaces presenting such unusual competition with the Valley furnaces.

The Steel Corporation's contract obligations are reported at 4,678,196 tons at the close of June, showing an increase of 413,598 tons during the month, against a gain of 102,354 tons in May and small losses in April and March. The June increase was equal to about one-third of capacity, while the shipments were about 80% of capacity, so that bookings exceeded capacity by a wide margin.

The bi-monthly wage adjustment at the iron mills showed a realized price on bar iron shipments from the selected mills in May and June above 1.10c., giving the tonnage men in the iron mills 1 to 2% higher wages for July and August.

The steel mills are operating at more than 80% of rated capacity, and openhearth capacity is practically fully engaged, the chief idleness being in bessemer departments, and efforts are being made to divert orders from openhearth to bessemer.

Pig Iron—Two or three Cleveland furnace interests have been selling basic iron over a wider range of territory than formerly, cutting out the Valley and some detached furnaces, and $12 or less at Cleveland furnace has been done. The Youngstown Sheet & Tube Co. is reported to have bought 30,000 to 50,000 tons at a very favorable price. At the same time the Valley furnaces have advanced quotations and are holding basic at $13 and bessemer at $14 at furnace, foundry and malleable remaining at $12.75 and forge at $12.50. The freight to Pittsburgh is 95c. from the Valleys, but on account of the competition of Lake front furnaces foundry and basic seem to be obtainable at about $13.50, delivered Pittsburgh. About 50,000 tons of export bessemer are in the market, 40,000 tons being in one lot, and as copper is barred this seems to shut out eastern bessemer.

Steel—The Pittsburgh mills have been practically out of the billet and sheet bar market for weeks and now the Youngstown mills are withdrawing, being well sold up, at least on openhearth. Consumers in general are well covered by contracts, but odd lots inquired for are drawing higher quotations right along. We quote: Bessemer billets, $20; bessemer sheet bars, $20.50; openhearth billets, $21; openhearth sheet bars, $21.50, f.o.b. maker's mill, Youngstown, the market delivered Pittsburgh being $1 higher.

Ferromanganese—The situation seems to be a shade easier, as contracts are more readily accepted at the regular price, $100, Baltimore, and prompt lots can be picked up at $100@105, Baltimore.

IRON ORE

Lake shipments of iron ore from the Lake Superior region in June were 6,005,091 long tons, an increase of 502,724 tons over June, 1914. From the opening of the season to July 1 the shipments by ports are reported by the Cleveland "Iron Trade Review" as follows:

Port	1914	1915	Changes
Escanaba	1,076,020	1,248,830	I. 172,810
Marquette	383,948	547,002	I. 163,054
Ashland	883,081	1,161,792	I. 278,711
Superior	3,733,502	1,777,600	D. 1,955,902
Duluth	1,779,876	4,295,811	I. 2,515,935
Two Harbors	1,767,689	2,490,248	I. 722,559
Total	9,624,116	11,521,283	I. 1,897,167

The increase from Duluth and the decrease from Superior are due to the termination of the Hill leases.

Sales of local iron ores to Eastern furnace have about reached the capacity of the mines. Foreign ores are nearly cut off by the ocean freight situation. This will probably result in increased sales of Lake ore in the East.

Imports at Baltimore for the week included 6490 tons of manganese ore from Brazil.

SAULT CANAL TRAFFIC

The total tonnage of freight passing through the Sault Ste. Marie Canals in June was 8,360,832 short tons, 7,990,390 tons using the American and 370,442 the Canadian Canal. For the season up to July 1 the total tonnage was in short tons; East bound, 13,006,133; west bound, 4,138,001; total, 17,144,134 short tons, an increase of 299,417 tons over 1914. The total number of vessel passages this year was 2581, showing an average cargo of 3075 tons.

The mineral freights included in the totals were as follows in short tons, except salt, which is given in barrels:

	1914	1915	Changes
Anthracite	702,339	678,852	D. 23,487
Bituminous coal	4,038,690	3,022,437	D. 1,016,253
Iron ore	9,112,590	11,072,607	I. 1,960,017
Pig and m'f'd iron	128,388	75,205	D. 53,183
Copper	18,287	41,272	I. 22,985
Salt, bbl.	343,204	232,173	D. 111,031

Iron ore was 64.6% and coal 21.6% of the total freight reported this year.

COKE

Coke production of the Connellsville region for the half year to June 30, 1914, is reported by the "Courier" at 7,336,643 short tons; shipments, 7,310,855 tons. Production of the Greensburg and Upper Connellsville district for the half-year was 923,665 tons.

The U. S. Geological Survey estimates the production of bituminous coal in the United States in the first half of 1915 at about 185,000,000 short tons, a decrease of 10% from last year.

Connellsville—Operators have stiffened materially in their views, chiefly on account of better prospects in pig iron and steel, and instead of quoting $1.75 on contract furnace coke for the second half are quoting $1.75 for July or third quarter, and $2 for the half year. On a flurry caused by fear of insufficient supplies over the national holiday spot furnace advanced from $1.50 to $1.75, but has now receded only to $1.60. Foundry remains at $2@2.40 for prompt and $2.20@2.50 for contract, per net ton at ovens.

Anthracite Shipments in June were 5,316,102 long tons, a decrease of 814,084 tons, as compared with June, 1914. For the six months ended June 30 the shipments were 32,945,789 tons in 1914, and 31,595,304 tons in 1915; a decrease of 1,350,485 tons, or 4.1%, this year.

British Fuel Exports, five months ended May 31, in long tons:

	1914	1915	Changes
Coal	28,852,713	18,775,284	D. 10,077,434
Coke	444,446	366,996	D. 77,450
Briquettes	852,326	509,471	D. 342,855
Steamer coal	8,500,680	6,334,542	D. 2,166,138
Total	38,650,170	25,986,293	D. 13,663,877

The total decrease was 35.3%, and was due entirely to war conditions.

Chemicals

NEW YORK—July 14

General market conditions have not materially changed. In some lines there is a good deal of activity, but others remain rather quiet.

Arsenic remains quiet but steady, with supplies sufficient for the demand. Quotations are steady at about $4 per 100 lb. for both spot and futures.

Copper Sulphate—The market shows a good demand and prices are steady at $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda continues in good demand and the market is strong and steady. Current quotations are firm at 2.35c. per lb. for spot and for all positions this year.

Potash Salts—U. S. Consul T. J. Albert at Brunswick, Germany, reports that the German market for potash is weak for this season of the year. It is hoped that the demand for manure salts will be more active in the fall and that difficulties of railroad transport will not again occur. The ocean export to foreign countries has ceased, since the Government issued its decree forbidding such export. Shipments to Austria-Hungary were not affected by the decree, and shipments to the Scandinavian countries and the Netherlands are allowed. On the other hand, shipments to Italy have been limited. The value of the exports of potash for the first four months of the present year amounted to $8,277,650, as compared with $11,840,403 for the same period in 1914. The decrease in the month of April was $1,230,609 as compared with April last year.

Pyrites—Imports at Baltimore for the week included 6887 tons of pyrites from Huelva, Spain.

PETROLEUM

Exports of mineral oils from the United States in May were 225,254,580 gal., or 30,303,984 gal. more than in May, 1914. For the five months ended May 31 the total exports were 903,071,386 gal. in 1914, and 866,456,249 gal. in 1915; a decrease of 36,615,137 gal., or 3.9%, this year.

The London "Petroleum Review" says that the latest information available is that the situation on the Galician oil fields is very serious. The whole of the remaining staffs have hurriedly left the oil-field region, many of them now being in Lwow. According to the "Pester Lloyd," the stocks of oil on the fields and at the refineries have been destroyed, while a fire which has been raging round Borysław-Tustanowice for several days has completely destroyed the majority of the derricks. It is reported that practically every operating company in the fields has suffered very considerable damage to its property.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Acacia, g.	Colo.	1,454,304	$ 1	$ 122,004	Jan '11	$0.01
Adams, s.l.c.	Colo.	1,438,989	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	80,000	25	2,550,000	Apr. '15	3.00
Alaska Mexican, g.	Alas.	50,000	5	3,489,381	May '15	0.20
Alaska Treadwell, g.	Alas.	180,000	25	15,285,000	May '15	1.00
Alaska United, g.	Alas.	200,000	5	1,865,070	May '15	0.40
Am. Zinc, Lead & Sm.	U. S.	180,200	25	983,320	Jan. '14	0.50
Anaconda, c.	Mont.	168,640	25	95,410,625	Apr. '15	0.25
Argonaut, g.	Calif.	4,992,500	5	1,660,000	June '15	0.10
Arizona Copper, pf.	Ariz.	200,000	20	2,121,274	May '15	
Arizona Copper, com.	Ariz.	1,426,120	20	17,092,498	Feb. '15	0.18
Bagdad-Chase, g., pf.	Calif.	1,519,890	5	202,394	Jan. '09	0.10
Baltic, c.	Mich.	84,819	25	7,950,000	Dec. '13	2.00
Bingham N. H., c.	Utah.	100,000	5	408,564	Mar. '15	0.10
Bonanza Dev., g.	Colo.	228,690	1	1,425,000	Oct. '11	0.20
Brunswick, g.	Calif.	395,287	1	179,597	June '15	0.06
Bunker Hill Con., g.	Calif.	300,000	1	840,000	June '15	0.02½
Bunker Hill & Sul., l.s.	Ida.	200,000	10	16,200,750	June '15	0.25
Butte-Alex Scott, c.	Mont.	327,000	10	148,000	Oct. '13	0.50
Butte & Ballaklava, c.	Mont.	74,000	10	125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida.	250,000	1	494,900	June '15	0.02
Calumet & Arizona, c.	Ariz.	617,385	10	21,559,443	June '15	0.50
Calumet & Hecla, c.	Mich.	616,758	25	126,250,000	June '15	5.00
Camp Bird, g.s.	Colo.	100,000	5	10,318,109	Jan. '15	0.08½
Centen'l-Eur., l.s.g.c.	Utah.	1,100,051	5	4,050,000	Apr. '14	1.50
Center Creek, l.z.	Mo.	100,000	10	526,000	Apr. '15	0.05
Champion, c.	Mich.	100,000	25	9,500,000	June '15	1.00
Chief Consolidated, s.g.l.	Utah.	871,384	1	262,983	Aug. '14	0.05
Chino, c.	New Mex.	777,458	5	5,175,560	June '15	0.75
Cliff, g.	Utah.	864,820	1	90,000	Jan. '13	0.10
Cliff, g.	Alas.	300,000	1	210,000	Oct. '13	0.01
Colo. Gold Dredging	Colo.	100,000	10	650,000	Sept. '14	1.00
Colorado, l.s.g.	Utah.	100,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s.	Utah.	1,000,000	5	226,832	Oct. '07	0.20
Commercial Gold	Ore.	285,540	1	43,750	Dec. '10	0.00½
Con. Mercur, g.	Utah.	1,000,000	1	3,445,313	July '13	0.03
Continental, z.l.	Mo.	22,000	25	330,000	Jan. '15	0.50
Copper Range Con., c.	Mich.	393,692	100	13,986,746	Oct. '13	0.75
Daly Judge, s.l.	Utah.	300,000	1	945,000	Apr. '15	0.15
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	45,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,783	100	3,550,969	Dec. '13	0.76
Eagle & Blue Bell, g.s.l.	Utah.	893,146	1	312,601	Oct. '14	0.05
Elkton Con., g.	Colo.	2,500,000	1	3,579,460	May '15	0.02
El Paso, g.	Colo.	490,000	5	1,707,545	Feb. '14	0.10
Ernestine, g.s.	N.M.	300,000	5	120,000	Dec. '12	0.05
Fed. M. & S., com.	Idaho.	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho.	120,000	100	9,856,503	June '15	1.00
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	258,000	Oct. '14	0.02
Frontier, z.	Wis.	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,305,000	Dec. '14	10.00
Gold Chain, g.	Utah.	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor.	Colo.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con.	Colo.	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g.	Colo.	1,500,000	5	3,990,000	June '15	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,558,367	10	27,932,086	Feb. '15	0.10
Grand Central, g.	Utah.	500,000	1	1,620,750	Sept. '14	0.05
Granite, g.	Colo.	1,650,000	1	270,000	Nov. '12	0.01
Hazel, g.	Cal.	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s.	Idaho.	1,000,000	0.25	3,280,000	June '15	0.02
Hercules, l.s.	Idaho.	1,000,000	1	5,725,000	June '15	
Homestake, g.	S. D.	218,400	100	37,824,478	July '15	0.65
Horn Silver, l.s.z.	Utah.	400,000	25	5,642,000	Sept. '07	0.05
Iowa, g.s.l.	Colo.	1,666,667	1	233,499	Aug. '14	0.00½
Iowa-Tiger Leasing g.s.	Colo.	12,655	1	9,250	Dec. '14	1.00
Iron Blossom, s.l.g.	Utah.	1,000,000	0.10	2,370,000	Apr. '15	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	4,950,000	Dec. '14	0.10
Jamison, g.	Cal.	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	187,500	Nov. '14	0.01
Kendall, g.	Mont.	500,000	5	1,505,000	July '14	0.06
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug. '09	0.12
Klar Piquette, z.l.	Wis.	20,000	1	259,000	Apr. '13	0.50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct. '13	0.00½
Liberty Bell, g.	Colo.	133,552	5	1,559,179	Sept. '13	
Little Bell, l.s.	Utah.	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah.	400,000	25	2,300,000	July '13	0.05
Mary McKinney, g.	Colo.	1,309,252	1	1,169,308	July '14	0.02
May Day, g.s.l.	Utah.	800,000	0.25	196,000	May '15	0.02
Mexican, g.s.	Nev.	201,600	2.50	161,910	June '14	0.75
Miami, c.	Ariz.	746,759	5	4,085,629	May '15	0.50
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk, c.	Mich.	100,000	25	3,375,000	Feb. '15	1.00
Monarch-Mad'a, g.s.l.	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	488,588	Dec. '12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,521	5	18,226,345	June '15	0.37½
New Century, z.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	1,680,000	Apr. '14	0.10
North Butte, c.	Mont.	410,000	15	11,890,000	July '14	0.50
North Star, g.	Cal.	250,000	10	4,637,040	June '15	0.20
Old Domin'n, M. & Sm.	Ariz.	162,000	25	7,290,000	June '15	0.50
Ophir, s.g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah.	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging.	Cal.	700,000	5	1,692,568	June '15	0.12
Osceola, c.	Mich.	96,150	25	12,371,998	Apr. '15	2.00
Parrot, c.	Mont.	229,850	10	7,497,189	May '15	0.15
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	7,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Iad.	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g	Nev.	2,790,000	1	771,200	July '14	0.02
Portland, g.	Colo.	3,000,000	1	9,903,080	Apr. '15	0.02
Quilp.	Wash.	1,500,000	1	67,500	Feb. '12	0.01
Quincy, c.	Mich.	110,000	25	21,227,500	June '15	2.00

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Ray, c.	Ariz.	1,482,436	$ 10	$3,812,160	June '15	$0.37½
Republic, g.	Wash.	1,000,000	1	170,000	Nov. '12	0.01½
Rochester, l.z.	Mo.	4,900	100	190,846	July '12	0.50
Round Mountain, g.	Nev.	866,426	1	363,365	Aug. '13	0.04
Seven Troughs Coal., g.	Nev.	1,500,000	1	75,000	Mar. '15	0.02½
St. Joseph, l.	Mo.	1,472,252	10	9,492,710	Mar. '15	0.05
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	2,275,000	Feb. '15	0.50
Silver King Coal., l.s.	Utah.	1,250,000	5	2,722,385	Apr. '15	0.15
Sioux Con., s.l.g.	Utah.	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal.	1,000,000	5	365,000	Oct. '14	0.01
Snowstorm, c.g.	Ida.	1,500,000	1	1,192,103	Oct. '13	0.02
South Eureka, g.	Calif.	299,981	1	391,880	Feb. '15	0.05
Standard Con., g.s.	Cal.	178,394	10	5,274,407	Nov. '13	0.25
Stratton's Ind., g.	Colo.	1,000,000	0.60	456,625	Dec. '14	0.03
Success, z.	Ida.	1,500,000	1	600,000	June '15	0.03
Superior & Pitts., c.	Ariz.	1,499,792	10	8,878,778	Mar. '15	0.20
Tamarack, c.	Mich.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	4,606,250	Apr. '15	0.75
Tomboy, g.s.	Colo.	310,000	4.85	3,634,065	Dec. '14	0.48
Tom Reed, g.	Ariz.	909,555	1	2,443,757	Apr. '15	0.06
Tonopah Belm't, s.g.	Nev.	1,500,000	1	7,268,010	Apr. '15	0.12½
Tonopah Ext., g.s.	Nev.	943,433	1	778,331	Apr. '15	0.07½
Tonopah of Nev., s.g.	Nev.	1,000,000	1	12,600,000	Apr. '15	0.25
Tri-Mountain, c.	Mich.	100,000	25	1,450,000	Dec. '13	2.00
Tuolumne, c.	Mont.	800,000	1	520,000	May '13	0.10
Uncle Sam, g.s.l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov. '12	0.01
United (Crip. Ck.) g.	Colo.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	10	2,127,500	Dec. '14	7.00
United Verde, c.	Ariz.	300,000	10	34,822,000	Feb. '15	0.75
Utah, s.l.	Utah.	100,000	10	281,860	Dec. '10	0.02
Utah, c.	Utah.	1,624,290	10	27,016,180	Mar. '15	0.75
Utah Con., c.	Utah.	300,000	5	8,700,000	Mar. '15	0.50
Valley View, g.	Colo.	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo.	1,500,000	1	3,172,000	Apr. '15	0.03
Wasp No. 2, g.	S. D.	500,000	1	469,466	May '15	0.00½
Wellington Mines, g.	Colo.	10,000,000	1	350,000	July '13	0.00½
Wolverine, c.	Mich.	60,000	25	8,220,000	Apr. '14	2.00
Yak, s.l.	Colo.	1,000,000	1	1,847,685	Dec. '14	0.02
Yankee Con., g.s.	Utah.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,163,789	May '15	0.02
Yellow Pine, l.z.s.	Nev.	1,000,000	1	481,008	Mar. '15	0.01
Yukon Gold, g.	Alas.	3,500,000	5	6,884,500	Mar. '15	0.07½

Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,879	$100	$92,484,306	May '15	$0.50
Am. Sm. & Ref., com.	U. S.	500,000	100	28,333,333	June '15	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	52,208,333	June '15	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	10,022,350	Apr. '15	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	14,750,000	Apr. '15	1.25
Greene Cananea.	U. S.	450,642	100	4,371,646	June '14	1.00
Guggenheim Expl.	U. S.	380,315	25	21,655,763	Jan. '15	0.87½
Inter'l Nickel, com.	U. S.	115,826	100	17,704,109	June '15	5.00
Inter'l Nickel, pfd.	U. S.	89,126	100	8,492,180	May '15	1.50
National Lead, com.	N. Y.	206,554	100	8,570,801	Mar. '15	0.75
National Lead, pf.	N. Y.	243,676	100	29,693,093	Mar. '15	1.75
Old Dominion, c.	Ariz.	293,245	25	6,000,390	Mar. '15	0.50
Phelps, Dodge & Co.	U. S.	450,000	100	38,234,304	Mar. '15	3.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	222,360,438	Dec. '14	0.50
U. S. Steel Corp., pf.	U. S.	3,602,811	100	376,903,174	May '15	1.75
U. S. S., R. & M., com	U.S.-Mex.	486,348	50	6,362,188	July '14	0.75
U. S. S., R. & M., pf.	U.S.-Mex.	351,114	50	15,518,569	Apr. '15	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,580,884	Feb. '15	0.03
B. C. Copper	B. C.	591,709	5	615,198	Jan. '13	0.15
Beaver Con., s.	Ont.	1,996,490	1	529,857	Apr. '15	0.03
Buffalo, s.	Ont.	1,000,000	1	2,757,000	July '14	0.03
Canadian Goldfields, g.	B. C.	600,000	0.10	290,000	July '14	0.001½
Chontalpan, g.s.l.z.	Mex.	7,000	25	59,500	May '14	0.75
Cobalt Townsite, s.	Ont.	45,000	1	1,042,259	May '14	0.10
Coniagas, s.	Ont.	800,000	5	7,480,000	May '15	0.30
Con. M. & S. Co. of Can	B. C.	58,052	100	1,942,809	Apr. '15	2.00
Crown Reserve, s.	Ont.	1,768,814	1	6,031,654	Apr. '15	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dos Estrellas, g.s.	Mex.	300,000	0.50	10,335,000	Dec. '13	1.50
El Oro, g.s.	Mex.	1,147,500	4.85	8,668,418	July '13	0.24
Esperanza, s.g.	Mex.	455,000	4.85	13,162,151	Mar. '15	0.24
Granby, s.l.c.	B.C.	148,496	100	5,533,457	June '14	1.50
Greene Con., c.	Mex.	1,000,000	10	9,544,400	May '14	0.50
Guanajuato D., pf., s.	Mex.	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold.	B. C.	120,000	10	1,644,000	June '15	0.50
Hollinger, g.	Ont.	600,000	5	3,453,000	July '15	0.20
Kerr Lake s.	Ont.	600,000	5	5,670,000	Mar. '15	0.25
La Rose Con., s.	Ont.	1,498,627	5	5,349,656	Apr. '15	0.25
Le Roi No. 2, g.	B. C.	120,000	£4.30	1,501,740	May '15	0.24
Lucky Tiger Com., g.	Mex.	715,337	10	3,069,960	June '15	0.09
McK.-Dar. Sav. s.	Ont.	2,247,692	1	4,405,471	Feb. '15	0.03
Mines Co. of Am. (new)	Mex.	1,700,000	10	*1,215,000	July '13	0.12½
N. Y. & Hond. Ros., g.	C. A.	200,000	10	3,670,000	Apr. '15	0.30
Nipissing, s.	Ont.	1,200,000	5	12,990,000	Apr. '15	0.25
Peñoles, s.l.g.	Mex.	80,000	25	6,361,688	June '13	1.25
Peregrina M. & M., pf.	Mex.	10,000	100	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex.	20,000	100	840,000	Oct. '13	3.00
Right of Way Mns'ts.	Ont.	1,685,500	1	219,115	Nov. '14	0.02
Rio Plata, s.	Mex.	374,518	5	345,745	Feb. '13	0.05
San Rafael, g.s.	Mex.	2,400	25	1,442,380	Jan. '14	0.50
San Toy, g.s.	Mex.	5,750,000	1	530,000	July '13	0.01
Sorpresa, g.s.	Mex.	19,200	20	3,979,240	Jan. '11	34.00
Stand'd Silver-Lead.	B. C.	2,000,000	1	1,550,000	Sept. '14	0.02½
Temiskaming, s.	Ont.	2,500,000	1	1,384,155	Apr. '13	0.06
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,940,250	Nov. '14	3.00
Trethewey, s.	Ont.	1,000,000	1	1,061,998	July '14	0.05
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	637,465	Oct. '13	0.05

*Previous to reorganization, $5,258,881.
†Previous to January, 1910, $324,644.

Assessments

Company	Delinqe	Sale	Amt.
Blue Bell, Ida	July 5	Aug. 4	$0.003
Blue Star, Ida	June 19	July 10	0.01
Carbonate, Ida	June 23	July 23	0.001
Challenge Con., Nev	July 12	Aug. 4	0.05
Con. Virginia, Nev	July 19	Aug. 10	0.05
*Contact Copper, Mich		July 14	0.50
Contact Copper, Mich	May 15		0.50
Four Timbers, Ida	July 28	Aug. 28	0.001
Hancock Cons., Mich	Sept. 1		1.00
Hancock Cons., Mich	Jan. 3		1.00
Houghton, Mich	May 25		1.00
Idaho-Nevada, Ida	July 14	Aug. 6	0.001
Iron Mask, Ida	July 1	Aug. 10	0.002
Ivanhoe, Ida	July 12	Aug. 12	0.002
Majestic-Idol, Nev	Dec. 15	July 20	0.005
Mayflower, Ida	June 15	July 17	0.005
Michigan Copper, Mich	July 19		1.00
Mineral Range, Utah	May 24		0.003
Monarch Pitts., Nev	June 14	July 14	0.01
Moonlight, Ida	June 5	July 8	0.005
Nabob, Ida	July 5	Aug. 2	0.005
New Arcadian, Mich	June 1		0.50
New Arcadian, Mich	Dec. 1		0.50
New Baltic, Mich	July 15		0.50
New Baltic, Mich	Jan. 15		0.50
New Yerrington Cop., Nev	July 9	July 27	0.01
Nevada Douglas, Nev	July 21	Aug. 18	0.10
North Bunker Hill, Ida	June 12	July 17	0.002
Old Veteran, Ida	July 5	July 31	0.002
Rainbow, Ida	July 7	Aug. 7	0.002
Rescue-Eula, Nev	July 14	Aug. 19	0.01
Revelator, Utah	Aug. 17	Sept. 3	0.00½
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Rhode Island, Ida	June 24	July 24	0.001
Sierra Nevada, Nev	July 27	Aug. 16	0.05
Silver Pick, Nev	June 5	July 12	0.01
Sonora, Ida	July 23	Aug. 31	0.004
Springfield, Ida	July 30	Aug. 30	0.002
Sunrise, Ida	July 17	Aug. 17	0.002
Sunset Dev., Ida	June 30	July 24	0.0025
Tarbox, Ida	July 17	Aug. 7	0.0025
Umatilla Tonopah, Nev	July 12	Aug. 16	0.01
Virginia, Ida., (post.)		July 29	0.02
West Tonopah Con., Nev	July 10	Aug. 10	0.01
Wyandot, Mich	July 28		1.00

*This assessment was levied and payable Apr. 27, '14.

Stock Quotations

Zinc stocks were especially active during the week, American Zinc, Lead & Smelting touching $60 on July 13. Auction sales of securities included: 3000 Princeton Copper M. & S., $1 ea., $4 lot; 2100 Gou Ganda-Cobalt Venture Corp., $1 ea., $4 lot; 300 Silver Eagle M., $1 ea., $1 lot; 2900 Sporting Times Ms. Corp., $1 ea., $2 lot.

COLO. SPRINGS July 13		SALT LAKE July 13	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.03½	Beck Tunnel	.04
Cripple Cr'k Con	.007	Black Jack	.09
C. K. & N	.03	Colorado Mining	.10
Doctor Jack Pot	.10½	Crown Point	.01½
Elkton Con	.38½	Daly-Judge	7.25
El Paso	.94	Gold Chain	.25
Findlay	.03	Grand Central	.61
Gold Dollar	.02	Iron Blossom	.70
Gold Sovereign	.03½	Little Bell	.10
Golden Cycle	1.79½	Lower Mammoth	.03½
Isabella	.17½	Mason Valley	2.25
Jack Pot	.06½	May Day	.21
Jennie Sample	‡.02	Opohongo	.00½
Jerry Johnson	.04½	Prince Con	.76
Lexington	‡.005	Seven Troughs	.01
Mary McKinney	.37	Silver King Coal'n	3.52½
Pharmacist	.005	Silver King Con	2.17½
Portland	1.40	Sioux Con	.02
Raven B. H	‡.02	Uncle Sam	.04
Vindicator	1.74	Yankee	.03½

TORONTO July 13			
Bailey	.02	Dome Exten	.13
Coniagas	4.75	Foley O'Brien	.29
Peterson Lake	.22	Hollinger	26.00
Right of Way	.03	Imperial	.05
Seneca Superior	11/16	Jupiter	.09
Silver Queen	.01	McIntyre	.51
T. & Hudson Bay	17.00	Pearl Lake	.01
Timiskaming	.34	Porcu. Crown	.70
Wettlaufer-Lor	.02	Preston E. D	.02
Dome Mines	20.37½	Res	.07

SAN FRANCISCO July '3			
Comstock Stocks		Misc. Nev. & Cal.	
Alta	‡.04	Belmont	4.00
Andes	.08	Jim Butler	.96
Belcher	.30	Lone Star	.05
Best & Belcher	.07	MacNamara	.02
Caledonia	.33	Midway	.16
Challenge Con	.07	Mont.-Tonopah	.17
Confidence	.10	North Star	.15
Con. Virginia	.09	Rescue Eula	.08
Gould & Curry	.04	West End Con	.80
Hale & Norcross	.05	Atlanta	.32
Julia	.02	Booth	.53
Mexican	.40	C.O.D. Con	.03
Occidental	.79	Comb. Frac	.08
Ophir	.18	Jumbo Extension	1.65
Overman	.07	Pitts.-Silver Peak	.08
Potosi	.02	Round Mountain	.52
Savage	.04	Sandstorm Kendall	.06
Sierra Nevada	.07	Silver Pick	.10
Union Con	.20	Central Eureka	.16
Yellow Jacket	.30	So. Eureka	1.50

N. Y. EXCH. July 13	
Name of Comp.	Clg.
Amalgamated	73½
Am.Sm.&Ref.,com	77½
Am. Sm. & Ref., pf.	106½
Am. Sm. Sec., pf. B	79
Anaconda	34½
Batopilas Min	1½
Bethlehem Steel	174½
Bethlehem Steel, pf.	117
Chino	46
Colo. Fuel & Iron	33
Federal M. & S., pf.	48
Great Nor., ore., ctf.	35½
Guggen. Exp	62½
Homestake	119
Inspiration Con	30¾
Mex. Petroleum	71½
Miami Copper	27½
Nat'l Lead, com	63¼
National Lead, pf	107
Nev. Consol	14¼
Ontario Min	2½
Quicksilver, pf	3½
Ray Con	23½
Republic I&S, com	29½
Republic I&S, pf	90
SlossSheffl'd, com	35½
Tennessee Copper	37½
Utah Copper	67½
U. S. Steel, com	60¼
U. S. Steel, pf	109½

N. Y. CURB July 13	
Alaska Juneau	13
Alta Con	.89
Beaver Con	.31
Big Four	.05
Blue Bell	.02
Braden Copper	6½
Buffalo Mines	.50
Can. Cop. Corpn	1
Can. G. & S	‡.05
Caribou	‡.50
Cashboy	.06
Chambers Ferland	.20
Chile Cop	19½
Con. Ariz. Sm	11/16
Con. Coppermines	‡2½
Con. Nev.-Utah	5/16
Davis-Daly	1½
Diam'field-Daisy	.04
Dia. Black B	.03½
Florence	‡.53
Goldfield Con	1 3/16
Goldfield Merger	.24
Greene Cananea	38½
Kennecott Cop	32¾
Kerr Lake	4¼
La Rose	.50
McKinley-Dar-Sa	.23
Majestic	.78
Mines of Am	‡2½
Nevada Hills	.22
New Utah Bingham	3¾
Nipissing Mines	5¼
Ohio Copper	.20
Oro	.09
South Utah	‡¼
Stand'd Oil of N.J.	398
Standard S. L	1¼
Stewart	2 5/16
Tonopah	7 7/16
Tonopah Ex	2 11/16
Tonopah Merger	.40½
Tribullion	1/2
Tularosa	‡ 1/16
Yukon Gold	‡2½

LONDON July 1			
Alaska Tre'dwell	£7	7s	6d
Cam & Motor	0	14	3
Camp Bird	0	5	0
El Oro	0	7	6
Esperanza	0	8	0
Mexico Mines	3	7	6
Oroville	0	14	0
Santa Gert'dis	0	7	6
Tomboy	1	2	0
Tough Oakes	0	8	6

BOSTON EXCH July 13	
Name of Comp.	Clg.
Adventure	2
Ahmeek	395
Alaska Gold M	37½
Algomah	2½
Alloues	54
Am. Zinc	58¾
Ariz. Com., ctfs	7 7/16
Bonanza	.37
Butte-Ballaklava	2½
Butte & Superior	71½
Calumet & Ariz	63½
Calumet & Hecla	565
Centennial	18
Cliff	‡1½
Copper Range	54½
Daly West	2½
East Butte	12½
Franklin	9¼
Granby	86½
Hancock	17½
Hedley	28½
Helvetia	.40
Indiana	5
Island Cr'k, com	49½
Island Cr'k, pfd	89½
Isle Royale	28
Keweenaw	2½
Lake	13½
La Salle	6½
Mass	12½
Mayflower	4½
Michigan	1½
Mohawk	72
New Arcadian	11½
North Butte	30½
North Lake	2
Ojibway	1½
Old Colony	3½
Old Dominion	53
Osceola	84
Quincy	86
Santa Fe	2½
Shannon	8½
Shattuck-Ariz	27½
Superior	28
Superior & Bost	3
Tamarack	36
Trinity	4½
Tuolumne	.45
U. S. Smelting	41½
U. S. Smelt'g, pf	45½
Utah Apex	4½
Utah Con	13½
Victoria	2½
Winona	4
Wolverine	61
Wyandot	.55

BOSTON CURB July 13	
Name of Comp.	Bid.
Alvarado	.70
Bingham Mines	8½
Boston Ely	.29
Butte & Lon'n Dev	.28
Calaveras	1½
Calumet-Corbin	.04
Chief Con	1 1/16
Corbin	‡.50
Cortez	.40
Crown Reserve	.50
Eagle & Blue Bell	1 1/16
First Nat. Cop	2½
Houghton Copper	3½
Iron Cap Cop., pf	5½
Majestic	.81
Mexican Metals	.23
Nevada-Douglas	.47
New Baltic	3
Oneco	1½
Raven Copper	.09
Smokey Dev	.15
So. Lake	‡6½
Tonopah Victor	.32
Trethewey	.10
United Verde Ext	4 1/16

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.495	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	.....	27.074	25.219	.....
August	59.293	54.344	.....	27.335	25.979	.....
September	60.640	53.290	.....	27.986	24.260	.....
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.991	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	.....	60.540	.....	64.955	.....
August	*	.....	‡	.....	‡	.....
September	*	.....	‡	.....	‡	.....
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53.227	.....	*	.....
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	.....	142.517	.....
August	*	.....	‡	.....
September	32.675	.....	‡	.....
October	30.284	.....	‡	.....
November	33.304	.....	1 9.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	.....	3.738	.....	19.051	.....
August	3.875	.....	3.715	.....	‡	.....
September	3.828	.....	3.658	.....	‡	.....
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	.....	4.770	.....	21.568	.....
August	5.568	.....	5.418	.....	‡	.....
September	5.380	.....	5.230	.....	‡	.....
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	.....	13.90	.....	13.90	.....
August	14.90	.....	13.90	.....	14.08	.....
September	14.99	.....	13.90	.....	14.03	.....
October	14.84	.....	13.75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....